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NOTES FOR THE MONTH.

THE Agricultural Rates Act, 1923, received the Royal Assent on 2nd August last, and gives effect to the undertaking given on behalf of the Government early in the year that further relief should be given to farmers in respect of local rates. It provides that occupiers of agricultural land, as defined in the Agricultural Rates Act, 1896, shall pay in respect of that land one-quarter of the rate in the pound payable in respect of buildings and other hereditaments. The amount by which it is estimated that farmers' rates will be reduced as a result of this concession is £2,750,000 for England and Wales and £480,000 for Scotland. The deficiency thus arising will be made good to the spending authorities by an additional grant from the Imperial Exchequer. The fixed grant already payable under the Agricultural Rates Act, 1896, is left undisturbed, but the new grant is to vary from year to year in accordance with the rise or fall of the rates.

The Act is to be deemed to have come into operation on the 1st April, 1923. Where before 1st September, 1923, a farmer has paid rates in excess of the amount that he is now liable to pay, the excess amount will be deducted from the next instalment of rates, or in certain instances will be recoverable in cash.

The Act is to continue in force until the 31st March, 1925, unless Parliament otherwise determines. Copies can be obtained from His Majesty's Stationery Office, Kingsway, London, W.C.2, price 3d. net, exclusive of postage.

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At the meeting, held on 11th September, of the Joint Committee of Producers and Distributors of Milk, agreement was

Milk Prices. reached as to the prices to be paid to producers for milk delivered into London during the twelve months October, 1923, to September, 1924.

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and as to the prices at which milk would be retailed in London during that period. These prices are as follows:—

<i>Months.</i>	<i>Producers' Price per imperial gallon.</i>	<i>Retail Price per quart.</i>
October, November and March ...	... 1/5	... 7d.
December, January and February ...	... 1/8	... 8d.
April to September ...	... 1/-	... 6d.

These prices compare with 1s. 8d. per gallon during the six winter months 1922-23 and 1s. per gallon during the six summer months of 1923, retail prices being 8d. per quart during the winter and 6d. during the summer.

Certain changes have been made in the scheme in force last year as regards the quantities of milk to be paid for as liquid and manufacturing milk respectively. For the new season these will be governed by the average quantities delivered during the basic period—the three months December to February. During the six winter months—October to March—the liquid milk price as above will be paid for 95 per cent. of the average quantities delivered during the basic period, the balance being paid for as manufacturing milk. In April, July, August and September, the liquid milk price will apply to 15 per cent. more than the quantity delivered during the basic period, and in May and June to 10 per cent. more. The price to be paid for manufacturing milk will be settled each month and will be 2d. per gallon less than the price per lb. of Canadian and New Zealand cheese.

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FARMERS have again had cause for apprehension owing to the number of outbreaks of foot-and-mouth disease which

Foot-and-Mouth Disease. have appeared in various parts of England during the past month. The two groups

of cases in Bedfordshire and Hampshire which commenced in July were stamped out by the middle of August. Unfortunately, fresh cases occurred on 27th August at Rotherham, and on 28th August at Blackpool. Subsequent outbreaks appeared in Cheshire, having been caused by the unloading at Crewe on 1st September, of animals from Fleetwood which had been indirectly infected by persons who had been amongst the affected animals at Blackpool. Animals from Crewe carried the disease into Buckinghamshire on 7th September, and into Salop (Baschurch) on 11th September. At the same time fresh centres of disease were established without any known origin near Southampton on 4th Septem-

ber, and at Torquay on 5th September, at Old Clee, Grimsby and Whitchurch, Somerset, on 23rd September.

The total number of outbreaks which have been confirmed on and subsequently to 27th August are as follows:—

Yorks. (W.R.)	1	Devonshire	4
Lancashire	12	Salop	4
Cheshire	22	Somerset	1
Southampton	5	Lindsey	1
Buckinghamshire	5		

Searching inquiries have been made by the Ministry into the movements of animals connected with all these outbreaks, and whilst it is still possible that further cases may arise on premises in the close vicinity of existing outbreaks, it is considered that the spread of the disease due to the infection of the loading docks at Crewe in the beginning of September has been checked, and that no further danger need be apprehended of a wider spread of disease arising therefrom. Every effort is being made locally to confine the disease centres within the narrowest possible limits.

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It is hoped that the Conciliation Committees will shortly be holding meetings for the consideration of rates of wages for the coming winter, and in this connection the Minister has addressed the following communication to the members of the employers' sides of the Committees:—

**Agricultural
Conciliation
Committees.**

"I hope that many Conciliation Committees will be holding meetings shortly for the consideration of rates of wages to be paid during the coming winter. Conditions vary in different parts of the country, but no doubt arguments will be brought forward by the labourers' representatives in support of an increase in wages while the representatives of the employers may on their side give reasons against such a decision.

"One point which in the opinion of the Government should be borne in mind by the employers in these discussions is that in the succeeding six months they will receive some substantial relief under the Agricultural Rates Act.

"As you are no doubt aware, this Act, which takes effect as from the 1st April, 1923, provides that an occupier of agricultural land in England shall be liable to pay only one-quarter (instead of one-half as hitherto) of the rate in the pound payable in respect of other forms of rateable property. Farmers will thus directly and immediately benefit as regards their

assessment to local rates, and to this extent will be in a more favourable position than would otherwise be the case.

"In the course of the proceedings in the House of Commons on the Bill, I stated that the labourer stood to gain by it and that I was convinced that its passage would have the effect of causing wages to rise. Should that not turn out to be the case it will make it much more difficult to pass any further measures designed for the benefit of agriculture as a whole.

"In these circumstances, I hope that you as the representatives of employers will take this fact into consideration in any discussions on your Committee as to rates of wages."

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The general index number of the prices of agricultural produce increased from 53 per cent. above 1911-13 in July to 54 per cent. above in August. On the whole,

The Agricultural Index Number.

August prices were on the same level as those of April and May, there having been a rise of 8 points from the minimum of June, due in the main to the much higher level of prices for potatoes of this year's crop. As compared with a year ago the general index number is lower by about 8 per cent.

The following table shows the percentage increase in each month since January, 1920 :—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	53
August	193	131	67	54
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

The prices realised for such of the new crops of wheat and oats as reached the markets during August were considerably lower than those paid for old crop, so that the average prices show an appreciable decline on the month, wheat falling by 11d. and oats by 1s. 9d. per cwt. Wheat averaged 29 per cent. above pre-war and oats 30 per cent. above, as compared with

58 and 59 per cent. above, respectively, in August, 1922, but last year the new crops were rather later in coming on the market. Barley remained steadier, and with some of the new crop of malting quality on the market the average price rose appreciably in the last week of the month. Potatoes show a further rise and early potatoes sold during August in the wholesale markets at 80 per cent. above pre-war as compared with only 14 per cent. above a year ago. Clover hay became appreciably cheaper during August, but meadow hay showed little change, and generally hay realised prices about 84 per cent. above pre-war.

The prices realised for fat cattle were 4d. per stone less than in July, but this reduction was relatively smaller than is usual at this time of the year, and the index figure consequently shows a rise of one point. Fat sheep prices were a shade higher on the month and averaged 76 per cent. above August 1911-13, a rise of 4 points on the month, sheep remaining relatively much dearer than other fat stock. Prices of fat pigs have risen steadily since the middle of July, but the average increase over July was relatively less than usual and the index figure dropped from 54 to 52 per cent. above pre-war.

The demand for the better classes of dairy cows improved during August and prices advanced, and at the end of the month first quality animals in milk were making about £1 10s. per head more than at the beginning of July. Store cattle are usually cheaper in August than in July, and the average decline of about 5s. per head as compared with last month leaves the index figure unchanged at 28 per cent. above August, 1911-13. Store sheep still remain very dear, and realised during August slightly more than double the pre-war price, whilst store pigs, though cheaper than in July, were also more than 100 per cent. above pre-war.

The average contract price of milk remained unchanged in the London and Birmingham areas, but advanced by 3d. per gallon in the Manchester district, so that over all contract prices advanced to 67 per cent. above August, 1911-13. Butter and cheese became appreciably dearer, butter averaging 2½d. per lb. more than in July, and cheese advancing by 11s. per cwt. Butter was therefore 48 per cent. and cheese 67 per cent. dearer than in August, 1911-13. Eggs also advanced more sharply than was usual in August before the war, the index figure showing a rise of 32 points to 68 per cent. above pre-war. Owing to labour troubles at the docks in Ireland, hardly any Irish butter or eggs were on the English

market during August, and part of the increases in the prices of English butter and eggs may be attributed to the consequent shortage of supplies.

The following table shows the average increases during recent months in the prices of the principal commodities :—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN
THE CORRESPONDING MONTHS OF 1911-13.
1922. 1923.

Commodity.	August	Apr.	May	June	July	August
Wheat ...	53	31	37	38	39	29
Barley ...	48	11	16	17	12	9
Oats ...	59	39	42	41	41	30
Fat cattle ...	70	51	53	52	45	46
Fat sheep ...	103	100	103	83	72	76
Fat pigs ...	92	71	72	69	54	52
Dairy cows ...	67	55	50	50	49	51
Store cattle ...	42	29	33	31	28	28
Store sheep ...	114	92	98	114	109	101
Store pigs ...	128	131	126	130	113	102
Eggs...	64	37	43	40	36	68
Poultry ...	85	75	77	87	79	61
Milk ...	70	70	63	53	57	67
Butter ...	77	68	40	33	37	48
Cheese ...	51	92	42	44	54	67
Potatoes ...	14	—28*	—28*	—31*	66	80
Hay ...	54	40	41	42	38	34

* Decrease.

THE Minister addressed the following letter to the Secretary of the National Farmers' Union of Scotland on 3rd September, in answer to correspondence on the question of the Agricultural Tribunal's recommendation that imports of foreign potatoes be permitted only under general licence :—

**The Potato
Position.**

“ In reply to your letters of the 11th and 28th August with regard to the import of foreign potatoes into this country. I would remind you that this question was very fully discussed at a deputation which I received on the 17th July last of English and Scottish farmers and potato growers, including Mr. Alexander Batchelor, the Vice-President of your Union, and, as I then explained, it would be impossible to secure the necessary Parliamentary sanction this year to your proposal for the restriction of imports of foreign potatoes. I then stated that the Cabinet had given the matter careful consideration and had decided not to propose legislation at the present time to

empower the Government to prohibit the import of potatoes from overseas.

"With regard to the low prices realised for potatoes in 1922, while imports of Dutch potatoes may have caused the fall in prices last summer to have been more rapid than might otherwise have been the case, there can be no doubt that the main cause of the slump was the abnormal yield of home-grown potatoes. A total production of about 4,000,000 tons from the agricultural holdings of Great Britain is sufficient for the country's needs, whereas the total production last year was about 5,200,000 tons. The total imports from foreign countries into Great Britain and Ireland in 1922 were 171,500 tons, or only 3½ per cent. of the total production of Great Britain alone, and of these 98,000 tons were early potatoes from France and the Channel Isles which are not generally considered to be competitors with the home-grown crop. Only 35,800 tons came from Holland and practically none came from that country after August, so that it cannot be seriously contended that imports from Holland kept prices at the very low level at which they remained throughout the season.

"Turning to this year it is true that the total imports up to date show an increase over 1922, but this has been entirely due to the large increase in imports of quite early potatoes from France and the Channel Isles: the imports from Holland have so far proved below the figures for the corresponding period last year. Whereas 7,274 tons arrived from France in the week ending 4th August, the import in the week ending 25th August had declined to 452 tons, from which it may be presumed that the French supply is now practically exhausted and was of the early variety.

"In addition the area under potatoes for human consumption in Holland is officially reported to be 20 per cent. less than last year, while the yield per hectare is expected to be lower.

"The Dutch exchange also is against this country, and this in itself would have a deterrent effect in purchasing potatoes from Holland. In fact the imports from Holland up to date ought not to have had any appreciable effect on the price of the British new crop, unless, as has been suggested, growers have been frightened into taking lower prices by reports of large supplies of Dutch potatoes being available or likely to become available at a low price. It is significant that last week it was reported at Hull market, an important market for Dutch potatoes, that the supply was practically finished and that this week no quotations were given.

" In your letter of the 11th and the accompanying resolution it was suggested that growers were expecting serious losses again this year, but the trend of prices up to date does not appear to confirm that contention. In the wholesale markets of England and Wales prices last week for first quality potatoes averaged £7 11s. per ton for Duke of York and £7 16s. for Sharpe's Express, while King Edwards were £9 per ton, whereas in the corresponding week of last year average prices for the same varieties were £3 16s., £4 and £4 16s. 6d. per ton respectively.

" Similarly in Scotland wholesale prices realised in the week ending 22nd August for first quality potatoes were from 70 to 100 per cent. higher than for the corresponding week last year, e.g., first earlies at Edinburgh and Glasgow were £7 and £6 13s. per ton respectively and £4 and £3 5s. per ton in 1922. The free on rail prices to producers both in England and Scotland show an even larger increase over last year's figures, e.g., at Wisbech, King Edwards were making £7 to £7 10s. per ton f.o.r. for the week ending 29th August against £2 10s. to £3 a year ago, and these prices are rather higher than the prices for the previous week, while last year at the same time prices were still declining. In Edinburgh first earlies were quoted at £5 5s. to £6 per ton on rail compared with £2 to £2 7s. 6d. per ton on rail at the same time in 1922. Again Dutch potatoes which were only on offer in two markets, Bristol and London, last week were realising £7 to £7 10s. per ton, which is very little below the rate for the best British early varieties.

" A further important factor in the potato situation is that the area under potatoes in Western Europe is generally lower than the area last year, while a lower yield is also anticipated. In England and Wales the acreage under potatoes has declined by over 94,000 acres (17 per cent.), and although the figures for Scotland are not yet available it is thought that they will also show a decline.

" It has been suggested that, owing to the depreciated currency German potatoes are reaching this country via Holland, consigned as Dutch, and that this might cause a serious depression of the British price. I have made enquiries on this point and find that the export of potatoes from Germany is entirely prohibited, so that there can be no question of any danger from such a source.

" In general I think that there is good reason to suppose that the fears of a serious loss again occurring in the potato growing industry this year are much exaggerated."

AGRICULTURAL LANDOWNERS.

II.

THE RT. HON. LORD ERNLE, M.V.O.

Landowners and the Supply of Cottages.—Another charge against agricultural landowners is that they provide an inadequate supply of cottages, and destroy independence by attaching their occupation to work on particular farms.

Admittedly there is a lack of cottage accommodation even in purely agricultural areas. But the deficiency is greatest in urban districts where wages are highest; it is smallest in agricultural districts where wages are lowest. In urban areas the building of small houses as a commercial speculation by private enterprise has, for various reasons, been checked. But on agricultural land cottages are very rarely built as a commercial speculation either for sale for profit, or as a remunerative investment. They are built by agricultural landowners because they recognise a duty to house the labour employed on their land. They build them also in their own interest. Without accommodation for the workers farms could not be let. The better the provision of good cottages, the better the class of farmer and of worker that the farm will attract. Apart from questions of water-supply or of distance from school, the sites of cottages are chosen so that men in charge of animals may be on the spot, and that other workers may be as near their work as possible. There are no trams or omnibuses in agricultural districts. This is the reason why the occupation of cottages is attached to employment on particular farms. And the system cuts both ways. A man who removes to work on another farm is reasonably sure to find a vacant cottage near the scene of his labour.

Nor are agricultural workers the only occupants of houses tied to the discharge of a particular duty. Prime Ministers, Chancellors of the Exchequer, First Lords of the Admiralty, all live in tied houses. In rural villages the position is still more common; it is more the rule than the exception. Every tenant farmer, most land agents, all woodmen, keepers, gardeners, rural postmen, policemen, and road-men, lose their local homes, if they lose their local job.

Still the system is not ideal. In towns, men may lose their employment in a particular factory, but they retain their homes. In agricultural districts, workers lose both together: they depend, in most cases, on their employers both for wages and

house. I wish that I could see any practical substitute for the existing system. On the estates on which I worked for many years, the cottages were not let to farmers who sublet to the men they employed; they were let direct to the workers by the landowner. The system gave no greater security of tenure to the worker. When a farmer dismissed a man, the Estate Office always gave the necessary notice to quit. But it had advantages. Workers, I think, liked to feel that one man paid their wages and another let them their cottage. Apart from this sentiment, cottagers found it easier to get repairs done or a smoky chimney corrected, and it made, though slightly, for permanence because no farmer likes to be known to his landlord as unable to keep his men. The system of direct letting by the landowner is more frequently adopted than is generally realised.

I am going to offer for consideration a Return made to the Land Agents' Society in 1914 relating to 22,727 cottages. They are not selected; they are on different properties; and they cover practically all the counties in England and Wales. But in fairness I must warn you that they may not be a perfectly fair sample. They are on large estates, and, however objectionable large estates may be, they are probably better equipped with cottages than most smaller properties.

There are then 22,727 cottages, built by agricultural landowners out of their own money to house the agricultural labour employed on their estates. Of them only 13,200 are occupied by the agricultural workers for whom they were intended. Of these, 5,508, or 41·73 per cent., are let direct by landowners to the occupants. Who occupy the remaining 9,527 cottages? With one class of occupiers everyone sympathises: 3,137 of the houses are occupied by pensioners and widows. Old age pensions have been an immense boon to rural districts. But their value has been greatly enhanced by the kindly feeling which has allowed old people to remain in their homes, either rent free, or at the cheap rates allowed to workers on the estates.

There remain 6,390 cottages built by agricultural landowners as part of their duty and interest, to house the agricultural labour employed on their estates. They are in the occupation of persons employed by the Government, or by Local Authorities, or by industrial capitalists other than agricultural landowners. All these occupants are brought there in the interest and for the convenience of their employers. If these employers did their duty as satisfactorily as agricultural landowners, and

housed the labour they employ, there would be little or no deficiency of cottages in agricultural districts.

One other point in this connexion may be made. County Councils are now the largest agricultural landowners. On the new holdings created since the war, houses have been generally provided for the small holders. But at the end of December, 1913, County Councils had provided 12,487 holdings. In the case of 2,159, houses had been sold or leased to the Councils. For the remaining 10,328 the Councils had built 609 houses, thus leaving 9,719 of their tenants, so far as they are concerned, homeless, depending on the provision made by others.

It is sometimes said that only a sixth, or 16 per cent., of the cottages in rural districts have gardens of more than an eighth of an acre. That statement is not confirmed by the Return. It shows that out of the 22,727 cottages, 6,350 have gardens of less than an eighth of an acre, and 16,377 have an eighth or more. That is to say slightly over 72 per cent. have gardens of 20 poles and upwards. The fact that so many of the men have gardens at their doors is one reason why the demand for allotments is relatively small in agricultural districts.

Even if it were conceded that some agricultural landowners are not bloated parasites, and that something may be said for the administration of some of their estates, the admission would not meet two other popular charges. One is that they have usurped the rights of the People and, to put it bluntly, are possessors of stolen goods; the other is that the private ownership of land is contrary to the laws of nature and natural rights. These are large subjects. It is only possible to suggest a few points for your consideration.

Possession of Stolen Goods.—The origin of private property in land is lost in the mists of antiquity. Possibly it originated very largely in the right of the first comer. When wandering hordes began to settle and cultivate the soil, individuals staked out their holdings, cleared them, and grew their crops. Public opinion recognised their claim to ownership. The right of the first comer is still acknowledged every day. An omnibus is a public conveyance. Everyone has a right, on payment, to a seat. But, as the omnibus fills up, the first comers sit, the later arrivals are strap-hangers. Whether this is or is not the main source of private property in land, most people would probably agree that it has stimulated the progress of civilisation. But, to-day, many think that, whatever its past services, it hinders the evolution of a more

perfect State. That is not my subject. Our question is whether there is any historical evidence that the People ever owned the land of the country. Ask any of the great historians of the University, and they would tell you, and, I believe, unanimously, that no evidence exists of the ownership of land by the community, and that there is, on the contrary, clear evidence in Anglo-Saxon times of estates owned by private persons, and cultivated by tenants both free and unfree, who paid to the owners labour services, or cash or produce, for the use of the land which they occupied and cultivated in common. Under different names, and in varying stages of development, manorial institutions existed among the Anglo-Saxons, if not in the Celtic age, centuries before the Conqueror reduced them to the system which, at the point of the sword, he imposed on conquered England.

On the antiquarian side, the charge, it may therefore be suggested, fails. Private property in land cannot represent a series of encroachments on the rights of the community, unless those rights ever existed, and of their existence there is no evidence. But the charge has also a modern side. To-day the land of the country is occupied in compact blocks by individual farmers who cultivate it by the labour of wage-earning workers. This uniform method of occupation and cultivation has displaced the older system of village farms occupied and tilled by groups of villagers, which may be traced through Norman, Anglo-Saxon, Roman, and, possibly, Celtic times. Whether this displacement of collective farming by individual farming meant a change of ownership is the point under discussion. On the answer rests the charge of robbery. Without dispute, the village open-field farms were occupied in common, cultivated in common, grazed in common. But to substantiate the charge of robbery, it must be proved that they were owned in common by the occupying cultivators.

The change from collective to individual occupation had been in gradual progress since the 13th century. But up to 1750, from a third to half the cultivated land of England was still occupied by groups of village farmers. It was in the reign of George III (1760-1820) that the change proceeded at an almost revolutionary pace. England was fast becoming a hustling manufacturing country instead of an easy-going agricultural country. Population rose rapidly. It shifted from the South to the North, and gathered round the coal and iron fields or the textile factories in densely crowded industrial districts from

which arose the cry for bread and meat. From 1798 to 1815 the demand for food was made more urgent by pressure of war and fear of famine. Under these changed conditions, drastic alterations were needed in village farms. They were self-sufficing, self-supporting units, raising food for the producers but little or no surplus for sale. To feed millions of artisans farms had to be changed from domestic industries for home consumption into factories of bread and meat, on which the new rotations of crops could be introduced, and live stock wintered and improved. The village farms were swept away. Economically, the policy succeeded. Between 1760 and 1821 population doubled: so, under improved farming, did production. In 1881-41 the land of the United Kingdom not only fed its additional population, but was feeding 8 million more people than it was feeding in 1914 or feeds to-day. The result is the more remarkable because agriculture had not yet recovered from the collapse which followed the peace of 1815, or profited by the discoveries of agricultural science.

The main features of the village farm were its arable land and its pasture. The former was generally divided into three great unfenced fields. Each year one field was sown in the autumn for wheat and rye; another was sown in the spring for barley, oats, peas and beans; the third field lay fallow. Each arable holding consisted of a bundle of acre or half-acre strips, equally distributed over the three fields, but designedly so scattered that no two strips were contiguous but were sometimes half a mile apart. The bundles of arable strips were held by different titles. Some of the holders were freeholders; others were copyholders holding of the Lord of the Manor on varying terms and conditions; others were leaseholders for lives, for life, or for terms of years; others were tenants from year to year, or at will. To these arable holdings were attached grazing and fuel rights over the pasture and waste, which were enjoyed by the same titles. Freeholders exercised them as part of their freehold; copyholders as part of their tenure; leaseholders and tenants as part of their tenancy. Grazing and fuel rights over the pastures and wastes were also attached to particular cottages. The owner of a privileged cottage exercised them as owner; the tenant of a privileged cottage enjoyed them in virtue of his tenancy and in consideration of the higher rent which he paid. Similar grazing and fuel rights might be acquired by squatters on the edges of the village farm, and legalised by lapse of time.

When Parliament sanctioned the enclosure of a village farm, commissioners surveyed and valued the land, and published an award in which they distributed it among those who proved ownership. Owners received a compact block of land corresponding in value to the scattered strips and grazing rights which they had owned in the village farm. There was no transfer of ownership—only a change in the subject matter owned. Those whose title was temporary and derivative—those, that is, who occupied under some form of tenancy—received no allotment in ownership. The same rule was followed with the cottages. Land in lieu of grazing rights was allotted to owners, not to tenants. Squatters of twenty years' standing were treated as freeholders: if their occupation was shorter their claim was dealt with as an encroachment and disallowed.

The awards of the Commissioners afford the best evidence on the charge of robbery. That small occupiers were opposed to enclosures, that the Parliamentary machinery was defective, that, over so large an area, mistakes were made or injustices done, must be admitted. But the awards show the number of ownership claims that were allowed. Many are in existence; a few have been printed. Twelve miles from Oxford is Steeple Aston where, in 1767, the village farm was enclosed. The award sets out both the new allotments and the quantities of arable land with grazing rights attached which the allottees had owned in the village farm. It deals with 968 acres. Tithe was extinguished by the allotment to the Rector of 156 acres. The remaining 812 acres were distributed in compact tithe-free holdings among 21 owners, according to the quantity and value of the land and common rights that they owned. The Lord of the Manor, Sir Charles Cottrell Dormer, received for his acreage and common rights 83 acres, a smaller area in quantity than he had owned in the farm. Three women are considerable freeholders. Lucy Buswell, in lieu of $4\frac{1}{2}$ yardlands and common belonging, received 84 acres; Judith Lamley, 56 acres; Eliza Davis, 53 acres. One cottage owner received, in lieu of his rights of pasture, an acre and a half of freehold tithe-free land. It is a question whether these 21 owners would have sacrificed their legal rights for the benefit of neighbours who had none.

One other piece of evidence may be added. A Return of the Enclosure Commissioners in 1876 states that, between 1845 and 1876, 590,000 acres were enclosed. The area was distributed among 25,930 owners. 620 Lords of the Manors received 27,000 acres, an average of $44\frac{1}{2}$ acres apiece. Owners other

than Lords of the Manor received an average of 24 acres apiece. The remainder of the land was sold to pay expenses. If these two examples stood alone, and of course they do not, they would not confirm the modern charge that the present estates of agricultural landowners originated in wholesale robbery under enclosures. The study of the awards rather supports the conclusion that they were built up by the more prosaic and legal processes of purchase, marriage and inheritance.

Assuming that, neither historically nor legally, can agricultural landowners be convicted of wholesale robbery, there remains the statement that private property in land is contrary to the laws of nature and to natural rights. This is a statement which cuts away at the roots the peaceful evolution of society. It starts the world afresh, and in this destructive force lies its fascination for ardent spirits yesterday and to-day.

Laws of Nature and Natural Rights.—If there was a body of laws of nature established by the universal consent of mankind, it would determine many difficulties. By reference to it we could decide what are the moral rights of individuals, and what ought to be their legal rights. But there is no such universal consent, and therefore the laws of nature have settled no controversies and promoted many. Each century has given a different answer to the question what they are. To-day no two communities, no two individuals would return the same reply. Consequently, the natural rights that are supposed to be founded on these unknown laws are only the rights which, in the opinion of the person who claims them, ought to be recognised by public opinion and sanctioned by law. Evidence so vague and contradictory affords no firm foundation for legislative action. Reasoning and proof are still needed.

The plausibility of the statement mainly depends on a confusion between ordinary laws and laws of nature. An ordinary law commands something to be done or left undone. It enjoins or forbids, and thus creates corresponding duties, rights and wrongs. But a law of nature only states facts. "The earth goes round the sun" is a fact, or, if you like, a law of nature. But it enjoins and forbids nothing, and creates no rights, wrongs or duties. The most that can be said is that every living creature possesses powers, faculties and capacities which correspond with the facts or laws of its nature. There is no natural reason why those powers should not be used to the full without regard to any other living creature, and their unfettered exercise is, if you like to call it so, a natural right. But no one necessarily

does wrong if he hinders the exercise of a natural right; it may even be his duty to resist it altogether.

Tigers are carnivorous animals. That is a fact or law of nature, and their powers correspond to the laws of their being. A man, therefore, is the God-given food of tigers. But he has no duty to be killed and eaten; he commits no wrong in resisting. Which kills which, depends on which is the strongest or the craftiest. "Man requires food and drink to sustain life." That is another fact or law of nature. If I, hard pressed by hunger, enter your house and eat your food, I am exercising a natural right, even though you starve. On the other hand, you have the natural right to knock me on the head, and eat your own food, though my starvation is the consequence. Neither tigers nor men do any natural wrong in exercising to the full their natural rights without any regard to others. Morality, mercy, justice, honour do not enter into the sphere of laws of nature. They belong to a different region of ideas. As regards tigers and men, or men and men, the exercise of natural rights means pandemonium, in which the weakest perish and the strongest survive.

Civilisation controls the exercise of natural rights, so that we may live together in progressive communities. For this purpose exist our code of morality, our ideals of honesty and justice, our civil and criminal law, marriage and other institutions. Take an illustration from the House of Commons. "Man communicates thought by articulate speech." That is a fact or law of human nature, and men have the vocal organs corresponding to this law of their being. It is their natural right to use those vocal organs freely, without regard to anyone else. Every member of Parliament, therefore, has the natural right to talk as loudly and continuously as he likes. That would be pandemonium, in which only the loudest voices would be heard. For mutual convenience the members submit to regulations; they forego their natural rights, and, except occasionally, only one member speaks at a time. In innumerable similar ways civilisation intervenes to control the exercise of natural right.

It would seem, therefore, that the peaceful progress of humanity is linked to the control of natural rights. We have recently experienced what the appeal to the laws of nature means. It was by those laws, and on the assertion of her natural rights, that Germany justified her war of aggression. In the public press, on platforms, in lecture rooms, in pamphlets and in less ephemeral literature, the argument was for many years deve-

loped. Germany needed more territory for her growth, and all men have equal natural rights to the use of all land. By conquest or fraud, so it was argued, Great Britain had appropriated a large part of the earth's surface. It is true that we had lavished our blood and our treasure upon our Empire; true that our possession had, in some cases, lasted for centuries; true that round it had gathered the reasonable expectations founded on a long period of quiet enjoyment; true that our exclusive occupation had been recognised in hundreds of international treaties and agreements. What do these things matter? One generation cannot rob another of the inalienable birthright of mankind. It is the natural right of nations as well as of individuals to seize and keep whatever they are strong enough to take. So a great nation turned its back on civilisation, abandoned its restraints, developed what a native writer called "the beast of prey conscience" and, by the brute force of numbers in the field, claimed the unfettered exercise of its natural rights.

The example might well make us hesitate to introduce into our domestic politics that appeal to laws of nature and natural rights which, in international politics, we defeated at the cost of rivers of blood and mountains of treasure. In a country without representative institutions, governed by an autocrat supported by a military aristocracy, the appeal is to numbers in the field and the arbitrament of battle. In a democratic country, with representative institutions, the appeal takes the shape of numbers at the poll, and the decision of the ballot. But in either case civilisation demands that honesty and justice, rather than mere force of numbers, should inspire Governments, and be the touchstone of action, whether international or domestic.

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THE GRADING, COMPOSITION AND FEEDING VALUES OF WHEAT OFFALS.

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As recently as in 1917, Wood and Adie* called attention to the circumstances which made it difficult to assign standard compositions and definite feeding values to the various grades of wheat offals. The confusion which had arisen was traceable

* See this *Journal*, Vol. XXIII, No. 12, March, 1917.

to two main sources. In the first place, there existed a lack of uniformity in the naming of offals, and it frequently happened that the same name was applied in different localities to samples of offals which varied widely in size of particles and chemical composition. In the second place, there was a great variation in milling practice in different parts of the country, and whereas most of the larger mills separated their offals into four grades, many of the smaller mills were content with a much simpler division.

In order to point the way out of the confusion which had arisen, Wood and Adie collected a number of representative samples of wheat offals from different districts and submitted them to investigation from a twofold point of view, namely, size of particles and chemical composition. As the samples were collected before the issue of the first Milling Order in 1917, the results of this examination may be taken as applying to normal pre-war wheat offals. As a result of sifting trials, it was concluded that where the offals were most completely separated, the division fell approximately into four grades:—

Grade 1.—*Fine middlings*, which did not pass through the silks ranging from Nos. 10 to 14 used for sifting out flour, but passed through silk sieve No. 3 (56 meshes per linear inch).

Grade 2.—*Coarse middlings*, which did not pass through silk sieve No. 3, but passed through wire sieve No. 24.

Grade 3.—*Pollards*, which did not pass through wire sieve No. 24, but passed through wire sieve No. 16.

Grade 4.—*Bran*, which did not pass through wire sieve No. 16.

In many mills, however, the offals were not so completely separated, and samples from these mills consisted of mixtures of two and sometimes even three of these grades. The results showed that, exclusive of the extreme bran grade, wheat offals could be classified into three "pure" grades (as above) and three "mixed" grades on the basis of size of particles.

That this system of classification possessed definite significance was shown by the chemical analysis of samples of the various grades. The average values obtained are shown in the following table, the results being calculated to the dry matter basis:—

TABLE I.

	<i>Protein.</i> per cent.	<i>Fat.</i> per cent.	<i>Carbohydrates.</i> per cent.	<i>Fibre.</i> per cent.	<i>Ash.</i> per cent.
Bran	15.57	4.53	61.40	12.25	6.25
Pollards	16.60	5.49	64.03	8.88	5.00
Coarse middlings	18.98	5.81	64.96	6.11	4.14
Fine middlings	18.05	3.94	73.11	2.13	2.77

It will be noted that the different grades are sharply differentiated on the basis of their chemical composition. The fine middlings are richest in carbohydrates, the amount of the latter decreasing continuously as the size of the particles increases. On the other hand, the percentages of ash and fibre increase continuously as the particles increase in size. The fat and protein are highest in the case of the coarse middlings and decrease either as the particles become finer or coarser than in this grade.

It followed from the results of this investigation that the adoption by the milling industry of a simple and uniform system of grading wheat offals would make it possible to assign to each grade a standard chemical composition. In other words, a uniform system of grading according to size of particles would automatically ensure that the chemical composition of middlings, fine middlings, etc., was uniform throughout the country. Moreover, by means of feeding trials, it would further be possible to assign to each grade not only a standard composition, but also a definite feeding value. Such a procedure would be of advantage both to the miller and to the buyer of offals. As Wood and Adie pointed out, it would not actually be necessary to interfere with local nomenclature, provided the offals were sold with a simple designation indicating size of particle.

Before dealing with the present-day grading of wheat offals, it is perhaps advisable to consider the meaning attached to the term "millers' offals" by the milling industry itself. The National Association of Millers was invited in 1913 by the Board of Agriculture to formulate a definition of this term. The following was the result: "That millers' offals, or wheaten offals sold as such, are the products of wheat and of the vegetable substances extracted from the wheats of commerce in the process of cleaning; but the proportion of such extraneous matter shall not exceed the percentage found in the wheats imported into the United Kingdom."

It follows necessarily from this definition that the screenings extracted from wheat, usually amounting to about 3 per cent., may quite legitimately be ground separately and mixed with the offals obtained from the cleaned wheat. As the screenings consist largely of very small berries, together with broken and shrivelled wheat, oats, barley and other seeds, it is clear that the mixed product, when ground, will contain a substantial proportion of material as fine as flour, and this is an important

source of the floury particles which find their way into the finer offals.

An examination of the characteristic grades of offals sold on the market at the present time reveals the interesting fact that important changes have been brought about as a result of official control exercised during the later years of the war. With the valuable co-operation of Dr. A. E. Humphries, of Coxes Lock Mill, Weybridge, it has been possible to make a systematic investigation of a very large number of representative samples of wheat offals. In all, eighty-three samples were collected from thirty-one firms trading in all parts of England and Wales. The firms in question were invited to send a sample of every grade sold in ordinary trading.

As a result of sifting experiments carried out by Dr. Humphries, it was found possible to divide the eighty-three samples into seven main groups as follows:—

TABLE II.

Group.	Size of particle.		Number of samples falling into group.	
A	At least 75 per cent.	over No. 10 wire sieve	...	13
B	At least 75	„ over No. 16 wire sieve	...	18
C	At least 75	„ over No. 24 wire sieve	...	14
D	At least 50	„ over No. 56 wire sieve	...	5
E	At least 50	„ over No. 56 wire sieve and at least 25	...	28
F	At least 50	„ through No. 56 wire sieve	...	2
G	At least 75	„ through No. 56 wire sieve	...	3

From these results the following points emerge:—

The groups A, B and C are merely sub-divisions of what has hitherto been regarded as one grade of offal, namely, bran. Subsequent chemical analysis confirmed this view. Broad or flaked bran is now produced in large quantities, and this extraction involves a division of straight-run bran. As a consequence, the finer grades of bran sold as medium bran, fine bran and No. 2 bran are obtained.

By far the most striking effect of war-time control, however, is the almost complete disappearance of the grade of offals formerly known as pollards. No sample was received which bore the designation pollards or corresponded with the grade of pollards tested by Wood and Adie in 1917. The term still appears to be used in a very few districts, and it is still also applied to some of the offals imported from the Argentine, but for all practical purposes, it can be said that control destroyed

the grade. It is probable that some of this product now finds its way into the fine brans and some, after regrinding, into the middlings. The samples of Group C, for instance, probably contain a proportion of this material, although chemical analysis, together with the fact that these samples only pass in part through the No. 16 wire sieve, establishes the offals in this group definitely as brans.

An examination of the detailed sifting returns for the samples in Group D revealed the fact that they cannot be regarded as constituting a typical or "pure" grade of offals, but rather as a "mixed" grade, intermediate between the finer brans and middlings. Since only five out of the total of eighty-three samples fell into this group, it was felt that no useful purpose could be served in taking them into account in feeding experiments designed to establish the food values of typical grades of offals.

The Group E offals may be taken as representing the average middlings now being produced in this country. The E and F groups differ in respect of the presence of a large number of finer particles in the F samples. Since the latter, however, represent such an extremely small fraction of the offals made and sold in this country, they can, like those of the D group, be left out of consideration when selecting typical grades for feeding trials.

The offals in Group G approximate to the old fine middlings and possess a special interest, although they constitute only a small portion of the total offals made in the country. Two of the samples came from South Wales, and the third from South Devon. In South Wales there is a great demand for high grade flour, whilst the demand for lower grade flours is correspondingly poor. In practice this results in a low extraction of flour from the wheats and the appearance of much low grade flour in the offals. As much as 48 per cent. of these very fine offals will pass through the No. 10 silk sieve. In other words, about half of this grade of offals is in reality low grade flour, and it would be possible to utilise these samples in the making of dog biscuits.

The next stage in the investigation concerned the chemical composition of the various groups of offals. Instead of submitting the whole of the eighty-three samples individually to analysis, composite samples representative of the seven groups were made up, each one containing a correct proportion of the original samples in the groups. The seven composite samples

were then analysed by Mr. A. J. Codling in this Institute with the following results, calculated to the dry matter basis:—

TABLE III.

Group.	Fat. per cent.	Protein. per cent.	Carbohydrate. per cent.	Fibre. per cent.	Ash. per cent.
A	5.19 ...	16.32 ...	60.86 ...	11.01 ...	6.62
B	5.30 ...	16.48 ...	60.84 ...	10.87 ...	6.61
C	5.41 ...	16.35 ...	60.90 ...	10.85 ...	6.49
D	5.99 ...	17.75 ...	61.41 ...	9.23 ...	5.62
E	5.68 ...	18.21 ...	65.61 ...	6.28 ...	4.22
F	5.60 ...	17.24 ...	66.44 ...	6.48 ...	4.24
G	4.62 ...	19.52 ...	70.56 ...	2.48 ...	2.82

It will be seen that little difference exists between the results for Groups A, B and C, the denomination of these groups as differing grades of one offal, namely, bran, being thus confirmed. The intermediate character of the Group D offals between bran and middlings is brought out by the figures, as is also the resemblance between the groups of middlings, E and F. The results for Group G lead one to anticipate a high feeding value for these very fine offals.

A study of the sifting results of the eighty-three samples, together with the results of chemical analysis of the seven composite samples, leads to the conclusion that present-day wheat offals may be divided into three main grades, namely, Brans (A, B and C), Middlings (E and F), and Fine Middlings (G). It is of interest, therefore, to compare the analytical results for the following three typical grades:—

TABLE IV.

Grade.	Fat. per cent.	Protein. per cent.	Carbohydrate. per cent.	Fibre. per cent.	Ash. per cent.
B Bran	5.30	16.38	60.84	10.87	6.61
E Middlings ...	5.68	18.21	65.61	6.28	4.22
G Fine Middlings	4.62	19.52	70.56	2.48	2.82

It is very clear from the above figures that the classification based on size of particles very efficiently separates the offals into grades which possess sharply differentiated chemical characters. The fine middlings show a high content of carbohydrates, as would be expected from the fact that they contain a large proportion of low-grade flour. The percentage of carbohydrates decreases continuously as the size of the particles increases. The fibre content displays a continuous variation in the reverse sense, being very low in the fine middlings and highest in the bran. A precisely similar variation characterises the ash content.

The amount of protein increases continuously as the size of particle diminishes. In respect of the fat constituent, the percentage is highest in the middlings, and decreases as the particles become either finer or coarser than in this grade. It will finally be noted that the above findings are in substantial agreement with those obtained by Wood and Adie in their work on the composition of pre-control wheaten offals.

Since wheat offals, as made at the present time, had thus satisfactorily been divided into three main typical grades, it now became necessary to carry out digestion trials on samples of these grades. It was hoped in this way to correlate size of particles not only with chemical composition but also with feeding value, and thus to encourage a universal production of offals on a simple and uniform basis. In deciding to continue the investigation in this direction, account was taken of the fact that the milling industry had been out of control for some considerable time, and that the present position as to the grading of offals is one which is likely, substantially, to continue so long as wheat and offals possess approximately the same relative values.

It is not necessary in this article to go into the method of experiment by means of which the digestibility and feeding value of a foodstuff are evaluated. The technique of this part of the work will be discussed fully elsewhere. It may, however, be mentioned that the trials were carried out in duplicate, and wether sheep were employed for the purpose. The offals being tested were fed in weighed amount, together with definite weights of linseed cake and chaffed meadow hay.

Two separate trials were carried out with bran, in order to compare ordinary bran with broad bran from the feeding value standpoint. Broad bran is ordinarily obtained by sifting out the largest flakes from straight-run bran, the remainder constituting medium bran or fine bran. From the broad bran practically all the dusty material has been removed. It is sometimes the practice to pass bran between smooth rollers. In this way "curly bran" is flattened, and the effect may be intensified if the bran is steamed immediately before rolling.

A considerable number of feeders prefer the larger flakes, and, consequently, the miller can command a better price—from 15s. to 35s. per ton more—for the broad bran. It is claimed that broad bran makes a better mash for stock and a

more bulky feed when soaked. Horses are said to prefer it and to do better on it, although its analysis does not differ materially from that of ordinary bran.

The broad bran tested in this experiment had been obtained by the simple sifting of straight-run bran. The main object of the comparison was to ascertain whether, from the standpoint of food value, there existed sufficient justification for the higher cost of broad bran and for the extra labour involved in effecting this division of straight-run bran.

For the purposes of the middlings feeding experiment, a large composite sample was made up, representative of the twenty-eight samples in Group E and the two samples in Group F. The whole sample was thoroughly mixed up in a suitable machine.

The sample of fine middlings was prepared so as to be representative of the finest offals obtained from the three representative firms conducting business in South Wales and South Devon.

The tables which follow summarise the results of the investigation into the feeding value of these various grades of offals. The results of simple analysis of the foodstuffs are given in Table V. The only new point which arises from this table lies in the results for the two brans, which display marked similarity. The ordinary bran appears to be slightly richer in protein and carbohydrate, but somewhat poorer in respect of fat. This difference is probably occasioned by the presence of fine particles in the ordinary bran.

TABLE V.

COMPOSITION OF WHEAT OFFALS USED IN FEEDING TRIALS.
(Calculated to dry matter basis.)

	<i>Broad bran.</i>	<i>Ordinary bran.</i>	<i>Middlings.</i>	<i>Fine middlings.</i>
	per cent.	per cent.	per cent.	per cent.
Protein ...	16.86	17.32	18.38	19.64
Fat ...	4.59	4.44	5.67	4.33
Carbohydrate...	59.83	60.71	66.05	70.16
Fibre ...	11.86	10.87	5.69	2.62
Ash ...	6.86	6.66	4.21	2.75

In Table VI are given the results expressing the so-called digestion coefficients of the constituents of the various grades of offals. By the term digestion coefficient is meant the number of parts of a constituent which are digested and utilised by the animal per 100 parts of that constituent consumed. In every case the figures represent the mean of the values obtained for the two sheep.

TABLE VI.
SUMMARY OF DIGESTION COEFFICIENTS.

	<i>Broad bran.</i> per cent.	<i>Ordinary bran.</i> per cent.	<i>Middlings.</i> per cent.	<i>Fine middlings.</i> per cent.
Dry matter ...	57.9	57.0	71.5	75.8
Organic matter...	61.6	60.9	75.4	78.2
Protein* ...	75.3	72.3	72.7	74.0
Fat ...	71.0	71.0	86.0	88.3
Carbohydrates†	62.7	63.5	78.2	80.9

* Protein (corrected) 88.3

87.0

90.0

91.0

† Including fibre.

It will be noted that the digestion coefficients for the constituents of the broad bran and ordinary bran display quite good agreement, leading to the conclusion that there is little to choose between the two brans from the feeding standpoint.

The figures for dry matter, organic matter, fat and carbohydrate show clearly a progressive increase in the digestibility of these constituents with decrease in the size of the particles constituting the offals.

This behaviour, however, is not displayed by the values of the protein digestion coefficients, and there can be little doubt that the protein of bran is almost as digestible as the protein of middlings and fine middlings.

In Table VII are tabulated the percentages of digestible nutrients in the different classes of offals. The results are arrived at by combining the data of Tables V and VI. The starch equivalents for maintenance and production and the nutrient ratios are also given.

TABLE VII.
AMOUNTS OF DIGESTIBLE NUTRIENTS AND FEEDING VALUES.

	<i>Broad bran.</i> per cent.	<i>Ordinary bran.</i> per cent.	<i>Middlings.</i> per cent.	<i>Fine middlings.</i> per cent.
Protein ...	12.69	12.52	13.36	14.53
Fat ...	3.26	3.15	4.88	4.26
Carbohydrate*	44.91	45.45	56.10	58.88
Maintenance starch† equivalent (lb.)	68.27	68.35	84.02	86.84
Production starch† equivalent (lb.)	49.09	49.20	67.95	79.12
Nutrient ratio‡ ...	4.12	4.19	5.02	4.71

* Including fibre.

† Per 100 lb. dry foodstuff.

‡ This figure gives the number of pounds of digestible carbohydrates and fats (fuel substances) which go with one pound of digestible protein (repair substance) in the foodstuff.

The results in Table VII very clearly substantiate the conclusion already arrived at, namely, that the two brans are

equal from the feeding point of view, and that the difference in price between the two foodstuffs cannot be justified on the grounds of feeding value.

The data further emphasise the statement made earlier in this communication, namely, that a simple uniform method of grading offals on the basis of size of particles yields grades which are characterised by a perfectly distinctive chemical composition (both in regard to crude and digestible constituents) and also by the possession of well defined feeding values.

The values of the starch equivalents are throughout higher than those attributed on somewhat speculative grounds to wheat offals by Wood and Adie. The latter investigators did not possess at the time any reliable digestibility data on which to base their calculations.

Attention should be directed to the excellent feeding value possessed by the fine middlings. From the feeder's point of view, it is to be regretted that so little of this class of offals is made in this country at the present time.

In conclusion, the writer would like to tender the thanks of the Institute to Dr. A. E. Humphries for his co-operation in the carrying out of this investigation.

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BARLEY GROWING.

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BECAUSE of its particular suitability to medium and light classes of soil, its value as a spring-sown crop and the facility with which the produce can generally be disposed of, barley continues to hold an important position in the ordinary farming rotation of a large portion of the country.

Soils.—Barley grows best on well-drained medium to sandy loams, with gravelly sub-soils, or in other words on free working, open, readily-drained soils, and the greater acreage of the crop in England is found in the eastern and southern counties, where soil conditions such as those described prevail. In the northern counties the area under barley is considerably less than in the south, owing both to the heavier soil there prevailing and to the later seasons and consequent tendency of the grain to ripen insufficiently. Even in these counties,

however, the selection of earlier ripening varieties for cultivation would tend to minimise the effect of these natural conditions.

Points of Good Malting Barley.—The points of good malting barley are:—(1) Good condition, by which is meant dry, well-handling grain, free from any smell of heating or of mould and with no trace of growing grains; (2) bright colour; (3) absence of cracked or skinned grains and of grains of which the germ has been injured or removed in thrashing; (4) evenness in size of grain; (5) finely wrinkled skin, which denotes good ripening; (6) the grain when cut across should exhibit a white, mealy surface.

It is recognised that soil and climate play an important part in determining the colour and quality of the grain, but with care in harvesting and thrashing many lots of grain which would otherwise be described as of medium quality, can be so improved as to obtain higher prices in the market than they do at present. Evenness in size of grain is a striking feature to the eye, and a little extra care in screening will secure this condition and so increase the selling value of a sample by several shillings per quarter. It is better to have a little good corn in the screenings than a little screenings in the good corn.

Cultivation.—Barley usually succeeds the root crop or another corn crop, its position in a rotation being determined to a large extent by the state of fertility of the land. For two reasons too high a state of fertility is undesirable for this crop: (a) on rich soil the straw is liable to be overgrown and will probably become laid with heavy rain, and (b) because with overgrowth of straw the grain tends to be thin and "steely" and thus unsuitable for malting.

The cultivation operations, after both roots and stubble, are very simple. The stubble land should be ploughed in autumn or early winter, and the root land immediately the last roots are either carted or eaten off. Once seeding time approaches, a cultivator may be run over the land or, failing this necessity, an ordinary harrow only.

The points to be remembered at this stage are that barley is a shallow-rooted, quickly-growing plant, and to obtain evenness in the composition of the grain—an important condition in malting barley—all cultivation operations should be performed so as to obtain the greatest uniformity possible.

Sowing.—The seed bed should be fine and dry and the seed deposited in the soil at regular depths and distances. It is desirable to sow barley with a seed drill, and, as a general rule, the distance between the rows should not be more than is absolutely necessary. The usual width of drill is 6 in., but on some soils good results are obtained at $4\frac{1}{2}$ in.

While it is inadvisable to sow too deeply, shallow sowing should also be avoided as the plants do not then obtain a sufficiently secure root hold, and with heavy rain and wind will lodge the more readily.

The quantity of seed used varies considerably with the class of soil and the time of sowing, and is affected also by special conditions, such as the existence of large numbers of rooks in the immediate neighbourhood, or the known liability to severe attacks of wireworm and leather jacket. As a general rule $2\frac{1}{2}$ -3 bushels is sufficient, but on very light soils this quantity may be slightly increased. When early spring sowing is practised, and still more with autumn sowing, heavier seeding is advisable.

The date of sowing is important. Provided the land is dry and a good fine seed bed can be obtained, the earlier in the season that barley is sown the greater will be the standing power of the straw and the higher the yield and quality of the grain. Granted such soil conditions, February is not too early, and it is frequently noticed that the weather in that month is more favourable than in March, and a good seed bed consequently easier to prepare.

Spring Treatment.—Treatment after sowing is of the simplest description and consists of light harrowing and rolling as soon as the plant commences stooling or tillering. If the crop is attacked by wireworms or leather-jackets, it may be necessary to repeat the rolling at intervals until the attack of these pests ceases or the plants grow too strong to suffer from them.

Charlock, an extremely objectionable weed, is sometimes very abundant in barley fields, and efforts should be made to eradicate it by spraying with copper sulphate. Details as to this method will be found in the Ministry's Leaflet No. 63.

If thistles and docks are present to any extent they should be removed by spudding as early in the season as is practicable.

Manuring.—When barley is sown after a root crop, the land is usually sufficiently rich with the residues of the manures applied to that crop, and the question of further manuring at this stage does not arise.

When sown after another corn crop, however, it is frequently necessary to apply some artificial manure. Unless the particular requirements of the soil are known beforehand, it is safest and most economical to apply a complete dressing, that is one containing nitrogen, phosphate and potash. A dressing which has proved useful is:—

1 cwt.	Sulphate of ammonia	per acre.
2-3	„ Superphosphate	„
2-3	„ Kainit	„

As barley is a shallow-rooted quickly-growing plant it requires its food material in a readily available form. Thus, of nitrogenous manures, those containing nitrogen in a soluble form are preferable to more bulky and slower acting ones, and the same remark applies to the phosphates, in which case the soluble form, superphosphate, is recommended.

On wold and chalky soils generally, nitrate of soda is sometimes preferable to sulphate of ammonia, when the same quantity in the mixture, namely, 1 cwt., is sufficient. Both of these manures should be used cautiously as they encourage straw development and tend to produce "steely" instead of the "mealy" grain desired by maltsters. In association with phosphates and potash, however, this tendency is very much reduced, and the quantities recommended above can then be usefully and economically employed.

The mixture of artificial manures should be applied to the land previous to sowing and immediately after mixing, when the harrowing before and after the seed-drill will incorporate it thoroughly with the soil.

On occasion it is necessary to apply some stimulating manure to assist the plant over a severe attack by leather-jackets or wireworms, and $\frac{1}{2}$ to $\frac{3}{4}$ cwt. (but not more) of nitrate of soda or sulphate of ammonia may be used as a top dressing.

When a field is known to be very rich and lodging is feared, a dressing of 2-3 cwt. of superphosphate may be applied at sowing time. This will hasten ripening, and at the same time stiffen the straw and assist materially in filling the grain.

Harvesting.—The actual harvesting operations of the barley crop are very much the same as those employed in the case of wheat and oats. Unlike these two crops, however, barley requires to be fully ripe and all traces of greenness should have disappeared completely from the straw and grain before it is cut. At this stage the grain is quite hard and should exhibit a finely wrinkled skin.

The length of time in the stook or shock will depend somewhat on the weather, and on the extent to which the butts of the sheaves are free from weeds. So far as it is practically possible everything in the sheaf should be thoroughly "killed" before carrying, as the chances of heating in the stack are greater with barley than with other cereals and the results are more serious. There is generally a slight natural heating in the stack, which, provided it does not proceed too far, matures the grain and is to this extent beneficial. All traces of sweating should have disappeared, however, before thrashing, otherwise the grain will exhibit an indifferent colour and will handle badly.

Thrashing.—Thrashing is one of the most important operations in handling the crop, and, as considerable damage may be done at this stage, more than usual care is urged upon growers to prevent unnecessary depreciation in the value of their grain.

The best of the barley crop is used for malting, and its commercial value for this purpose is considerably higher than for any other. Consequently, almost every grower endeavours to reach this standard, and it should only be necessary to point out some of the obvious causes operating against him to secure their correction.

Malting barley is valuable on account of the starch it contains, but this cannot be utilised by the brewer until it is converted into a sugar called maltose—a change brought about in the grain during the early stages of growth of the young plants. It is thus absolutely necessary that in malting barley the germ should not be removed or injured in any way during thrashing. In addition, when any portion of the skin of the barley corn is removed the grain is liable to mould on the malting floor and thereby impart a disagreeable flavour to the malt. Unfortunately grain exhibiting these features is met with frequently, with the result that the buyer either refuses to purchase a sample exhibiting these defects or offers a much reduced figure for it.

One of the principal causes of such maltreatment is the rapidly revolving drum of the thrashing mill, which when set too close to the breast (or concave perforated screen between which and the drum the straw and attached grain passes) will break or skin the grain or remove the germ from it. The thrashed corn should be examined immediately the thrashing mill is working at full speed, and when damage is detected the breast should be set at a greater distance from the drum, an easy alteration for an experienced machine driver to make.

Apart from direct damage done as a result of a badly set drum, skinned and broken grain may be caused by over-feeding or by passing quantities of loose grain through the machine, or, again, by the feeder not opening the sheaves sufficiently before they reach the drum. These are all small errors that can be detected readily and rectified without any serious trouble.

Damage is occasionally caused by the hummeller, but the fault here does not lie so much with this portion of the machine as with too heavy feeding, when the hummeller-case becomes choked with grain, thereby resulting in excessive friction of one grain against another.

The tendency to over-thrash, that is, to thrash the grain too closely, is probably a result of the demand for grain of a high bushel weight—a relic of times when the quality of malting barley was judged in this way. This standard is changing, and to-day the buyer places more importance on the uniformity of size of grain and good thrashing, and grain with a small portion of the beard adhering is valued more highly than closely thrashed material.

Bad screening is frequently the result of over-feeding the machine and should be avoided as it operates against evenness in size of grain.

Seed.—The essential character of good seed is that it will grow and produce strong, healthy plants, and it is imperative that farmers before sowing should make themselves sure of the value of the seed they propose using; further, not only should the seed be capable of growing, but it should do so vigorously.

Another point here arises of special application to barley: varieties do not all behave alike on the malting floor; some grow to the length necessary to effect the changes of starch into maltose quicker than others, whilst others require slightly different treatment in regard to the amount of water used or in the extent to which they are turned on the floor. The practical effect of this is that bulks of grain consisting of a *mixture* of varieties are not as valuable to the maltster as those consisting of a single variety. Not only is this so, but it has been shown that *pure* seed of any variety produces more grain per acre than mixed seed and thus on two scores it is important for the grower to sow seed of a single pure variety. Commercial stocks of such seed are already available, and they will naturally increase in quantity in proportion to the demand.

In some parts of the country, and more severely in some years than others, barley suffers from attacks of smut, a

disease so familiar to barley growers that it does not require detailed description here.

The presence of smut in a crop means a direct loss of grain varying with the intensity of the attack, but as the spores spread to unaffected grain during thrashing, an additional monetary loss is entailed, as a result of the depreciation in colour and general appearance of the bulk of the grain.

Various means of controlling smut have been suggested, and formalin solution, 1 pint of formalin to 80 gallons of water, sprayed or sprinkled on the grain just before sowing, is one of the most easily prepared and at the same time one of the most effective fungicides.* Although this is an effective control, it is impossible in practice to secure immunity, and the grower is well advised to make it a practice to draw his seed requirements from smut-free crops.

Varieties for Sowing.—Within recent years considerable attention has been directed to the question: Which are the best varieties for malting and at the same time the most remunerative to the grower? Fortunately, it has been found possible to combine high yield, good malting quality and strong straw, and it now only remains for growers to ascertain the suitability of several recently introduced varieties bearing these characteristics for the special conditions of soil and climate with which they have to deal.

Spring-sown Varieties.—Varieties of spring-sown barleys are divided into two classes, broad and narrow-eared, according to the shape of the ear.

As a rule broad-eared types are best suited to good loams and heavier classes of soil, and the narrow-eared to lighter soils. The broad-eared varieties succeed well in the northern districts as they are earlier ripening than the most valuable of the narrow-eared types.

For a time broad-eared varieties suffered from "necking," or loss by ears dropping off the straw on ripening or as a result of heavy winds, but several new forms have been bred and introduced into commerce in which this defect has been remedied (see below).

Narrow-eared Varieties.

ARCHER.

Grain - Not very large, colour rather grey, finely wrinkled skin.

Straw - Short and wiry, ear very seldom detached from the straw either by wind or in handling during harvest.

Soil and Climate Suits a wide range of soils but is perhaps best on light and medium loams; on heavier soils is inclined to be late in ripening.

Remarks A prolific variety, generally producing good malting samples; on poor soils it succeeds better than any other type.

* Leaflet No. 328 (*Smut in Oats and Barley*).

SPRATT-ARCHER.

- Grain* - Slightly larger and brighter coloured than Archer; finely wrinkled skin.
- Straw* - Similar to Archer, but somewhat stiffer; leaves finer.
- Soil and Climate* In regard to soil, generally similar to Archer, but will probably succeed on richer soils better than that variety.
- Remarks* A hybrid variety obtained by crossing Archer and Spratt; more prolific and of higher malting quality than Archer and earlier ripening.

GOLDTHORPE.*Broad-eared Varieties.*

- Grain* - Large and bright coloured.
- Straw* - Long and generally erect, but becomes brittle on ripening and the ears are then liable to break off.
- Soil and Climate* Suited to heavy loams and later districts.
- Remarks* One of the best broad-eared varieties in regard to both yield and malting quality. Earlier ripening than Archer and slightly earlier than Spratt-Archer.

PLUMAGE-ARCHER.

- Grain* - Large, good colour, and finely wrinkled skin.
- Straw* - Erect and not so long as Goldthorpe, and the ears are not liable to fall off the straw when ripe.
- Soil and Climate* Suited to good and heavy loams, and, as it is earlier ripening, to later districts.
- Remarks* A hybrid variety, raised by crossing Plumage, a broad-eared barley, and Archer. In yield and quality occupies a leading position amongst present-day varieties.

ARCHER-GOLDTHORPE.

- Grain* - Large, good colour, and very finely wrinkled skin.
- Straw* - Short, erect and stiff, and ears are not liable to break off the straw when ripe.
- Soil and Climate* Suited to good and heavy loams, and, as it is distinctly early ripening, to late districts.
- Remarks* A hybrid variety obtained by crossing Archer and Goldthorpe. In yield not equal to Spratt-Archer, but in quality it equals or possibly exceeds that variety. Should succeed well on heavy soils in late districts.

MALTSTER.

- Grain* - Large, good colour.
- Straw* - Fairly long and erect.
- Soil and Climate* Suited to good and heavy loams and to late districts.
- Remarks* A hybrid variety obtained by crossing four varieties. Except on a few soils it is not equal in yield to narrow-eared forms or to some of the more recently introduced broad-eared forms. Malting quality good.

SPRATT

- Grain* - Large and coarse.
- Straw* - Fairly long, erect and stiff.
- Soil and Climate* Especially well suited to soils with large quantities of peaty matter in their composition.
- Remarks* Almost entirely a feeding barley on soils such as those mentioned; this variety produces very heavy crops but the quality of the grain is poor and is usually only fit for feeding.

1917.

- Grain* - Large and good colour.
Straw - Fairly long, strong and stiff. Ear erect and free from "necking" or breaking off the straw.
Soil and Climate Suits a wide range of soils.
Remarks A prolific form, with undoubtedly good standing straw. Quality varies considerably with the soil on which the crop is grown; somewhat inclined to coarseness.

Autumn-sown Varieties.—In some districts it is the custom to sow barley in the autumn, and for this purpose varieties of six-rowed types are commonly used, mainly on account of their winter hardiness.

Varieties of this class are distinguished from those sown in the spring by the character of the ear in which there are six rows of fully developed grains instead of the usual two. Two well-marked divisions of winter varieties exist, one similar to the broad-eared varieties in the two-rowed classes in so far as the grains are set closely together on the stalk of the ear, and the other similar to narrow-eared varieties in the greater distance between the grains on the ear stalk.

Both divisions are usually known by their botanical names, *Hordeum hexastichum* and *Hordeum vulgare*, but the latter has in addition the much commoner names, "bere" or "bigg."

Dense ears (analogous to broad-eared varieties).

HORDEUM HEXASTICHUM.

- Grain* - Fairly large.
Straw - Short, stiff and wiry with a tendency to become brittle when fully ripe.
Soil - Is probably best suited to good heavy loams.
Remarks A good winter-hardy variety which produces heavy crops of grain of from medium to very fair quality.

Lax ears (analogous to narrow-eared varieties).

HORDEUM VULGARE (Bere or bigg).

- Grain* - Fair size but somewhat uneven in shape owing to the twist in the four lateral rows of the ear.
Straw - Medium length, wiry.
Soil - Suited to a varied range of soils provided they are well drained.
Remarks A good winter barley variety producing heavy crops of grain of from medium to very fair quality.

The grain of both classes of winter barley is liable to be thin and not, as a rule, of particularly good malting quality, but on suitable soils heavy crops are produced which, if not up to malting standard, can be utilised with advantage for stock feeding.

Winter barley resembles the varieties usually sown in spring in its inability to exist in badly-drained soils, and, as it has naturally to live through the wettest months of the year, this essential condition of well-drained soil must not be overlooked.

* * * * *

LIVE STOCK IMPROVEMENT IN ENGLAND AND WALES IN 1922-23.

The Ministry's Live Stock Scheme has now been in operation for nine years, and the progress made during a period of exceptional difficulties indicates that its objects and methods are being increasingly appreciated by the farming community. The Scheme aims at grading up the inferior stock of the country by the introduction of more systematic and careful methods of breeding; this end is being achieved by educating farmers to the use of sound pedigree sires and to the keeping of records of the milk yields of their cows, and financial assistance is provided to bring these methods within the reach of the smaller farmers. The progress of the Scheme on these lines may be gauged from the figures given in the tables in the present report for 1922-23 (1st April-31st March).

BULL AND BOAR SCHEMES.

YEAR.	BULLS.			BOARS.		
	No. of		Total	No. of		Total
	Societies.	Individuals.	Animals.	Societies.	Individuals.	Animals.
1914-15*	369	43	497	115	—	115
1915-16	489	28	633	180	—	193
1916-17	548	15	659	186	15	216
1917-18	578	14	710	172	92	264
1918-19	604	7	721	156	167	350
1919-20	568	6	675	120	225	399
1920-21	561	6	668	135	285	441
1921-22	725	3	847	113	416	550
1922-23	831	1	947	93	451	569

* Including the period 1st February, 1914—31st March, 1914.

Bulls.—It is very satisfactory to find that notwithstanding the agricultural depression there has again been a marked increase in the number of premium bulls located under the Scheme during the year ended 31st March, 1923; 947 bulls were located as compared with 847 during the previous year, and of

these no fewer than 553 were Shorthorns, followed by 94 Lincoln Red Shorthorns. As a result of the drop in the value of stock there was a general decrease in the average prices paid for all breeds, the general average price falling from £72 10s. 5d. in 1921-22 to £62 11s. 9d. The highest price paid for a bull provided under the Scheme was £273 for a Hereford bull, while 57 cost £100 or over. There was a marked increase in the number of service fees of 5s., and the numbers of the higher fees were on the whole well maintained. The number of bulls serving at the popular fee of 5s. was 490, while 274 served at higher, and 212 at lower fees. Premium bulls and their progeny have again scored many successes at Shows. As an instance it may be mentioned that a Shorthorn bull provided by one of the Bull Societies has during the 1922 Show Season won 8 champion cups, 2 reserves for cup, 13 first prizes, 8 second prizes and 2 third prizes.

Results of the continued use of good sires are now becoming apparent in districts where the Scheme has been in operation for some time. For example, a large dealer in Yorkshire recently expressed the opinion that the improvement effected by the Scheme had raised the value of the cattle bred in his district by fully £9 per head.

NUMBER AND AVERAGE PRICES OF BULLS.

Breed.	1914-15.		1921-22.		1922-23.	
	No.	Price.	No.	Price.	No.	Price.
British Friesian ...	1	£ s. d. 37 0 0	7	78 18 7	6	77 15 8
Devon ...	16	41 0 0	70	64 9 2	90	59 10 3
Guernsey ...	—	—	6	54 4 2	7	53 9 3
Hereford ...	63	33 0 0	78	68 15 2	84	58 3 4
Linc. Red ...	33	32 0 0	89	73 1 8	94	63 14 11
Shorthorn ...	337	38 0 0	492	76 5 10	553	64 16 3
Red Poll ...	—	—	1	78 15 0	1	78 15 0
South Devon ...	6	37 0 0	20	69 5 2	17	58 11 6
Welsh Black ...	35	29 0 0	60	57 2 7	64	52 2 11
Other Breeds ...	6	28. 0 0	—	—	—	—
All Breeds ...	497	36 0 0	823	72 10 5	916*	62 11 9

* 947 bulls were located, but grants in respect of 31 were in suspense at the end of the year.

Service Fees.

Year.	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	9/-	10/-	Over 10/-
1914-15	365	57	41	42	3	88	—	—	—	—	1	—	—	—	—	—
1921-22	46	38	26	74	7	346	1	48	3	6	160	6	4	2	51	6
1922-23	50	40	28	84	10	430	3	53	2	10	141	7	8	2	45	6

Boars.—The progress made by the Boars' Scheme during the year ended 31st March, 1923, has been slight as compared with the marked progress reported for the preceding year, but new ground has been broken and there is evidence that the Scheme has led to marked development of the pig-breeding industry in certain districts. For instance, reporting on a boar located at Alvechurch, Birmingham, the Live Stock Officer stated that the location of a premium boar had been followed by the introduction of at least 15 other pedigree boars in the district. Of the 569 boars located 199 were of the Large White breed and 141 of the Large Black, followed by 77 of the Middle White breed. As in the case of bulls there was a general decrease in the average prices paid for the various breeds, the general average price being £15 0s. 4d. as compared with £18 3s. 0d. for the previous year. The highest figure for the year is represented by a Gloucestershire Old Spots which had an estimated value of £63. The service fees showed a relaxation of their upward tendency, but there was a substantial increase in the number of fees of 5s., 300 boars serving at this fee, 172 at higher, and 74 at lower fees.

Subsidised boars and their progeny have again been very successful at Shows; and the following typical instance may be of interest. At the fourth Annual Show held at Keresley on the 24th August, 1922, premium boars, sows served by premium boars, and the progeny of premium boars carried off five first prizes, four second, three third and one special prize, leaving for the other pigs one second, one third and one special prize only.

NUMBER AND AVERAGE PRICES OF BOARS.

Breed.	1914-15.		1921-22.		1922-23.	
	No.	Price.	No.	Price.	No.	Price.
Berkshire	10	£ s. d. 8 0 0	11	23 19 10	11	£ s. d. 18 2 3
Cumberland	—	—	32	17 11 10	30	16 5 0
Essex	—	—	7	33 11 5	4	23 7 6
Glouc. Old Spots	7	7 0 0	51	21 4 4	37	21 8 0
Lincoln Curly Coat	4	8 0 0	24	13 0 4	31	12 3 10
Large Black	18	7 0 0	157	17 3 6	141	14 12 7
Large White	64	7 0 0	167	17 5 1	199	13 13 10
Large White Ulster	—	—	—	—	2	16 0 0
Middle White	12	7 0 0	62	19 4 3	77	15 11 7
Tamworth	—	—	1	17 0 0	1	20 0 0
Wessex Saddleback	—	—	11	22 16 11	13	16 2 3
All Breeds	115	7 0 0	523	18 3 0	546*	15 0 4

* 569 boars were located but grants in respect of 23 were in suspense at end of year.

Service Fees.

Year.	2/-	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	10/-	Over 10/-
1914-15	21	62	10	5	6	—	2	—	—	—	—	—	—	—	—	—
1921-22	1	10	13	13	36	6	245	1	42	5	7	111	3	3	22	10
1922-23	—	7	12	13	37	5	300	—	51	4	2	99	—	4	13	1

Sheep.—The Scheme for the improvement of Welsh Mountain Sheep, to which financial assistance was first given by the Ministry in 1919-20, is growing in popularity. During the year under review grants at the rate of 3s. 4d. per ewe served, up to a maximum of £10, were made to 14 societies in respect of 17 approved pedigree rams; 1,041 selected ewes were served, being an average of 61 per ram. In accordance with the Regulations the ram, ewes and progeny are required to be ear-marked. The average hiring fee of the rams was £9 15s. 4d., and the average service fee was 1s. 2d. The rams hired were of the best quality, including prize-winners at the Welsh National and County Shows, and the Scheme is greatly appreciated in the districts for which it is provided.

Milk Recording.—During the recording year 1st October, 1921, to 1st October, 1922, the Milk Recording Section of the Scheme has continued to make steady progress, three societies and 19,000 cows having been added. The Scheme is now operating in practically every county in England and Wales. The following table shows the progress made as regards the number of societies, members and cows since the inauguration of the Scheme in 1914:—

MILK RECORDING.

	Year.*	Societies.	Members.	Herds.	Cows.
1st April to 31st March	1914-15 ...	16	264	306	7,331
	1915-16 ...	20	350	398	9,811
	1916-17 ...	22	441	495	12,950
	1917-18 ...	25	503	555	14,404
1st October to 30th September	1917-18 ...	27	639	708	19,733
	1918-19 ...	38	1,191	1,332	37,880
	1919-20 ...	46	2,075	2,312	61,323
	1920-21 ...	52	3,328	3,664	97,903
	1921-22 ...	55	3,949	4,362	117,023

* Prior to 1st October, 1917, there was no uniform year for Societies.

It will be observed that the tendency is for societies to grow in size rather than in number. This is due to the fact that the majority of the societies have now extended the scope of their operations so as to cover the whole of their respective counties. In other cases where there are several small contiguous societies endeavour is being made to amalgamate them

so as to form strong county societies. There are 14 societies with a membership of over 100, 19 with a membership between 50 and 100 and 22 with less than 50 members. A table showing certain particulars of all the societies is given in the table on p. 618.

Increase in Average Yields.—The annual returns furnished by the 55 societies for the recording year under review show that of the 117,023 cows and heifers recorded, 54.1 per cent. were cows which had been retained in the herds for the full year, and the average yield for these full-year cows was 6,670.81 lb.—an appreciable advance on the average for the previous year when the full-year cows, which represented 49 per cent. of the cows and heifers recorded, gave an average of 6,562.95 lb. The averages shown in the following statement indicate that the yields of milk-recorded herds are steadily increasing year by year:—

Comparison of Average Annual Yield for Societies for the Last Four Milk-Recording Years.

Year 1st Oct. to 1st Oct.	No. of Societies.	Particulars of all Cows and Heifers recorded.			Particulars of Cows recorded for full year.		
		No. of Cows and Heifers.	Total Yield (gal.).	Average Yield (gal.).	No. of Cows.	Total Yield (gal.).	Average Yield (gal.).
1918-19	38	37,880	16,204,941	450	17,989	10,543,516	579
1919-20	46	61,323	29,344,887	479	27,266	17,363,347	637
1920-21	52	97,903	48,512,380	495	48,248	30,892,620	640
1921-22	55	117,023	80,463,617	517	63,318	41,208,073	65

The following figures, taken from the records of the Oxfordshire Society, show how the average yield per cow is being raised in certain herds, and are typical of what is occurring in many herds. The figures show the average yield per cow during the first year of recording as compared with the average yield during the year ended 1st October, 1922.

Herd.	Average Yield per Cow during Year.			
	Year.		Year.	
A	...	1916-17	...	1921-22
B	...	1915-16	...	"
C	...	1918-19	...	"
D	...	"	...	"
E	...	1919-20	...	"
F	...	"	...	"

As a further instance it may be mentioned that in Montgomeryshire a smallholder with 25 acres of poor land, by

careful selection, had six cows averaging 1,048 gallons, and that he attributed his success mainly to selection and to advice given on rations.

Issue of Certificates.—The number of milk record certificates issued to members was 2,482. This number represents 2.08 per cent. of the total number of cows recorded, and 9.84 per cent. of the number of cows which were recorded for the full year. Of the 2,482 certificates issued only 228 were for yields of less than 6,000 lb., while 627 certificates, i.e., over a quarter of the whole number, were for yields of 8,000-9,000 lb.

The sixth volume of the Ministry's Annual Register of Dairy Cattle was issued in July last. It contains particulars of 1,499 cows (belonging to 805 members) in respect of which certificates have been issued by the Ministry, showing that they have yielded 8,000 lb. or over of milk during the milk recording year ended 1st October, 1922, or an average of 6,500 lb. for that year and one or more preceding consecutive years. Fourteen recognised breeds or types are represented in the sixth volume, and there are in addition 98 cross-bred cows (i.e., cows which do not conform to one recognised breed or type) whose milk yields have justified their inclusion under the standard required. Of the 1,499 cows entered in the sixth volume 1,271 gave over 8,000 lb. of milk during the year, and 228 were entered on an average of 6,500 lb. or over. Of the 1,271 cows which were entered on the one year's yield 554 gave between 8,000 and 9,000 lb.; 382 between 9,000 and 10,000 lb.; 181 between 10,000 and 11,000 lb.; 99 between 11,000 and 12,000 lb.; 44 between 12,000 and 13,000 lb.; 26 between 13,000 and 14,000 lb.; 11 between 14,000 and 15,000 lb.; 6 between 15,000 and 16,000 lb.; 4 between 16,000 and 17,000 lb.; 5 between 17,000 and 18,000 lb.; 4 between 18,000 and 19,000 lb.; 8 between 19,000 and 20,000 lb.; 1 between 20,000 and 24,000 lb.; and 1 over 24,000 (viz., 24,465½ lb.).

This issue of the Register contains the first list of cows in respect of which certificates of merit have been issued, certifying that such cows have yielded not less than 24,000 lb. of milk over a period of three consecutive years and have calved at least three times during that period. Another interesting feature of the volume is the addition of a Bull Section, which is intended to be of use to farmers who desire to obtain the services of bulls of proved milking strain. Bulls are eligible for this section if their dams and sires' dams have been entered in the Register, or if they have two or more daughters so entered. It is hoped

that as the Register becomes more widely known and its object more generally understood, farmers will avail themselves of the useful information which it contains.

Calf Marking.—The Ministry's calf-marking scheme, the adoption of which is optional, has now been taken up by all but one of the societies. The number of animals marked under this Scheme during the year was 11,517, as compared with 7,891 during the preceding year.

Cost of Milk Recording.—As regards the financial side of milk recording it is satisfactory to find that the cost of recording no longer shows the marked tendency to increase which has been noticed in previous years, and it may reasonably be expected that as the societies expand and become more efficiently organised a reduction in cost will result.

Commercial Value of Milk Recording.—The commercial value of milk recording continues to be demonstrated by the prices realised at sales for recorded non-pedigree cattle and their progeny, and the following are particulars of some of the sales which have been reported to the Ministry.

At a sale on the 29th November, 1922, at Twyford, non-pedigree Dairy Shorthorns realised an average price of 49 guineas for 46 cows and heifers, the highest prices being 71, 70, 65, 64 and 62 (three times) guineas. The Live Stock Officer stated that "Recording increased the value at least £15 per cow," and the Press opinion was that "the sale was one of the most successful of its kind this year."

At the Lancashire Milk Recording Society's fifth Autumn Show and Sale on the 7th November, 1922, 70 non-pedigree cows and heifers, mainly Dairy Shorthorns, realised an average price of 45 guineas, the highest prices being 100, 81, and 80 (twice) guineas.

At the autumn show and sale promoted by the Cumberland and Westmorland Milk Record Sales Association at Penrith, on the 9th November, 1922, 80 non-pedigree Dairy Shorthorn cows and heifers averaged 47 guineas, the highest prices being 115, 100 and 75 guineas.

At a sale on the 2nd October, 1922, of the herd of a member of the Berkshire Milk Recording Society, 59 non-pedigree Shorthorn and British Friesian cows realised an average price of 47 guineas, the highest prices being 92, 90, 74 (twice), 72 (twice), and 70 guineas. The Live Stock Officer reported that the general opinion was that recording had increased the value at least £15 to £20 per head.

APPENDIX A.—STATEMENT giving particulars of 55 Milk Recording Societies operating during the year ended 1st October, 1922.
(The Societies are arranged in order of total number of animals recorded.)

NAME OF SOCIETY.	Number of Members.	Number of Herds.	Total No. of animals recorded.	No. of cows recorded for full year.	Av. yield of cows recorded for full year.
Essex County	188	213	7,467	4,095	lb. 7,166
East Sussex	185	217	6,317	3,302	6,811
Berkshire	114	134	5,161	2,756	6,590
Hampshire	126	145	4,704	2,366	6,668
North West Wilts.	95	107	4,636	2,931	6,438
Dorset	68	99	4,468	2,466	5,796
Kent	146	167	4,361	2,059	6,966
Hertfordshire	139	151	4,308	2,195	6,896
Surrey	155	164	4,052	2,035	6,646
Yeovil	109	129	4,000	2,436	6,124
Salisbury and District (Wilts.)	59	86	3,941	2,463	7,108
Norfolk	139	160	3,840	2,347	6,810
Lancashire County	135	142	3,513	1,570	6,703
Oxfordshire	95	113	3,350	1,765	6,390
West Sussex	90	100	3,085	1,822	6,923
Warwickshire	121	130	3,043	1,480	6,733
Suffolk	105	118	2,430	1,545	6,790
South Devon	95	103	2,423	1,094	5,956
Leicester	80	83	2,176	1,114	6,953
Northants	79	90	2,120	1,103	6,312
Shropshire	71	79	2,084	1,411	6,772
Cambridge and District	79	86	2,083	1,120	7,248
Cheshire County	57	63	2,017	1,043	6,639
Cumberland and N. Westmorland	142	142	2,005	970	5,971
Yorkshire	113	121	1,992	918	7,120
Staffordshire	74	77	1,954	1,111	6,986
Nottinghamshire and District	52	57	1,676	715	6,810
Derby and District	42	45	1,509	677	7,049
Bristol and Bath	78	79	1,503	805	6,664
Buckinghamshire	53	59	1,407	707	7,235
Denbighshire and Flintshire	72	73	1,392	816	6,641
Worcestershire	58	60	1,389	652	6,556
Cadbury (Somerset)	46	56	1,232	696	6,336
Warminster and Mere (Wilts.)	26	29	1,227	823	6,434
Tees Valley (Durham)	36	44	1,120	517	7,242
Peak (Derby)	36	36	949	294	6,829
Frome and District (Somerset)	23	23	924	697	6,211
East Devon	51	53	899	458	6,054
Kendal and S. Westmorland	40	41	828	463	6,011
Bodfordshire	31	32	744	363	6,691
Campden, Moreton and District (Glos.)	34	36	740	467	6,328
North Somerset	27	31	696	432	6,538
Anglesey and Carnarvonshire	52	53	653	394	5,561
United Counties	40	41	652	382	6,480
Lincolnshire	30	32	645	372	6,346
Cornwall	42	43	630	329	5,612
Allendale (Northumberland)	35	36	601	344	6,775
Shepton Mallet and District (Somerset)	15	17	596	439	6,017
Monmouthshire	28	30	583	193	6,257
Cheltenham and District (Glos.)	23	25	534	370	7,564
Melton Mowbray and District (Leic.)	24	24	627	287	6,063
Hertfordshire	24	24	487	296	6,763
Quedgeley and District (Glos.)	30	31	484	287	6,863
Montgomeryshire	27	27	478	243	5,865
Highbridge and District (Somerset)	15	16	388	228	6,467
TOTALS	3,949	4,362	117,023	63,318	6,670

At Amberley Court, Monmouth, on the 5th September, 1922, the herd of a member of the Monmouthshire Milk Recording Society was sold by auction. The herd consisted of 26 pedigree Shorthorn cows and heifers. 8 pedigree Shorthorn calves, 12 non-pedigree Shorthorn cows and heifers, and 2 non-pedigree Shorthorn calves. The highest prices for the pedigree cows were 110 guineas (twice), 100 guineas and 92 guineas, and for the pedigree calves 82 and 90 guineas. For the non-pedigree cows the highest prices were 160, 100 and 95 guineas and for the non-pedigree calves 26 guineas. The average price for the 12 non-pedigree cows was 67 guineas as against 57 guineas for the 26 pedigree cows—good evidence of the value of milk recording.

At the spring sale of Dairy Shorthorns at Penrith on the 11th May, 1922, a non-pedigree recorded cow, the property of a member of the Cumberland and North Westmorland Milk Recording Society, realised £108.

The following are the principal memoranda used in connection with the live stock operations of the Ministry, and copies of them can be obtained free of charge on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

Leaflet 282...	...	Scheme for Improvement of Live Stock.
Leaflet 146...	...	The Value of Records of the Milk Yields of Cows.
No. 609/T.L.	(L.2)	Bull Grant Regulations.
No. 392/T.L.	(L.4)	Milk Recording Regulations.
No. 446/T.L.	(L.11)	Boar Grant Regulations.

* * * * *

LIGHT HORSE BREEDING IN 1922-23.

The operation of the Light Horse Breeding Scheme during the season 1922 (1st April-31st March) followed the usual lines except that for reasons of economy the number of Ministry's Premiums was limited to 15, and only 57 instead of the usual 85 King's Premiums were awarded at the Thoroughbred Show in 1922 owing to the lack of stallions of sufficient merit to justify the full number of awards.

Premiums awarded for 1922 Season.—The following Premiums were awarded for the season 1922:—12 Super Premiums, 45 King's Premiums, and 15 Ministry's Premiums (all thoroughbred horses except 8 Ministry's Premiums, which were awarded to 1 Hunter Stallion and 2 Cleveland Bay Stallions), 5 Riding Ponies, 18 Welsh Cobs, 3 Welsh Roadsters, 4 Dales Ponies, 5 Fell Ponies, 10 New Forest Ponies, and 43 to Mountain Pony Stallions in Wales.

Service Season, 1922.—The numbers of mares served by the various classes of stallions were as follows:—

	<i>No. of Mares Served.</i>	<i>Average per Stallion.</i>
12 Super Premiums...	855	71
45 King's Premiums ...	3,034	67
15 Ministry's Premiums...	872	58
5 Riding Pony Premiums ...	205	41

Foaling Results from Service Season 1921.—The foaling percentage of stallions is calculated upon Returns furnished to the Ministry by the mare owners, and the results from the 1921 Service Season were as follows:—

	<i>No. of Mares served in 1921.</i>	<i>No. of Returns furnished to Ministry.</i>	<i>Average Percentage.</i>
12 Super Premiums...	941	883	51
48 King's Premiums ...	3,407	3,154	54
26 Ministry's Premiums ...	1,398	1,228	54
5 Riding Pony Premiums...	263	243	60

The highest percentage (71) was obtained by two stallions "Ednam" and "Cock-a-Hoop," owned respectively by Messrs. T. and H. Ward and Lt.-Col. Sir Merrick R. Burrell, Bart., C.B.E.

Thoroughbred Show, 1923.—The Annual Show of Thoroughbred Stallions for the purpose of awarding Premiums to stallions for the service season 1923 was held at the Royal Agricultural Hall on 27th and 28th February and 1st March, and the Judges were Messrs. Ernest Bellaney and Romer Williams. The number of entries was 87, one less than in 1922. A satisfactory feature of the Show was the entry of 24 new stallions, of which 9 were considered to be of sufficient merit to receive an award. One of these, "St. David," the property of H.M. the King, took third place among the Super Premium winners. The full number (60) of Premiums (including 12 Super Premiums) was awarded, and the King's Cup was won for the fourth year in succession by "Gay Lally" belonging to the Compton Stud, the Reserve horse being "Scarlet Rambler" as in the previous three years.

Horse Breeding Act, 1918.—During the licensing year 1st November, 1921, to 31st October, 1922, there was a marked decrease in the number of stallions licensed under this Act, the number being 3,479 as compared with 3,816 in the preceding year. There was, it is satisfactory to note, a proportionately greater decrease in the number of stallions for which licences were refused. There were 165 refusals, 16 of which were

after appeal, the numbers for the previous year being 244 and 18 respectively.

Of the 3,479 licensed stallions, 3,129 were pedigree animals and the remaining 350 were horses that were not entered or accepted for entry in any recognised Stud Book.

The following tables show the number of stallions of each breed concerned that were licensed or rejected, and the number refused licences in respect of the various prescribed diseases or defects:—

NUMBER OF STALLIONS LICENSED OR REFUSED.

<i>Heavy.</i>	<i>Pedigree.</i>		<i>Non-Pedigree.*</i>	
	<i>Licensed.</i>	<i>Refused.</i>	<i>Licensed.</i>	<i>Refused.</i>
Shire	2,052	106	122	8
Clydestale	237	16	7	1
Suffolk	216	8	2	1
Percheron	47	—	2	—
Others	—	—	80	5
<i>Light.</i>				
Hackney	213	5	41	2
Thoroughbred	150	7	4	—
Arab	17	1	3	—
Hunter	4	—	3	—
Cleveland Bay	9	—	—	—
Yorkshire Coach	2	—	—	—
Welsh Roadster	5	—	1	—
American Trotter	1	—	4	—
Others	—	—	18	—
Ponies (including Welsh Cobs) ...	176	3	63	2
<i>Totals</i>	3,129	146	350	19

* Non-pedigree stallions are arranged as far as possible under types.

NUMBER OF STALLIONS REJECTED UNDER THE PRESCRIBED DISEASES AND DEFECTS.

Roaring	37	Defective Genital Organs ...	6
Whistling	39	Springhalt	11
Sidebone	29	Shivering	8
Cataract	15	General Unsuitability ...	1
Ringbone	16		
Bone Spavin	3	<i>Total</i>	165

Twenty-eight appeals were made against refusals of licences, and in 12 cases these were successful.

Notwithstanding the decrease in the number of stallions licensed the Ministry has information which suggests that the number of unsound stallions which formerly travelled at very low fees, and which constituted the most serious hindrance to grading up of horse breeding, have been practically eliminated from the road. Since the Horse Breeding Act came into force

the Ministry's Inspectors and Live Stock Officers and the Police have endeavoured to secure observance of the Act by stopping stallions on the road and requiring the production of the licences, and in cases where the Regulations have been infringed proceedings have been taken by the Police. The fact that there was a marked decline in the number of prosecutions is evidence of a more general knowledge of and compliance with the Act on the part of stallion owners.

National Stud.—The operations of the National Stud during the year ended 31st December, 1922, continued to be satisfactory, under the able direction of Capt. Greer. The profit for the year amounted to approximately £3,000, bringing the accumulated Trading Profit up to £39,550 since the establishment of the Stud in 1916. It is very satisfactory to record that the National Stud headed the list of Winning Breeders for the year 1922 with 25 horses winning 42 races of a total value of £82,989.

During the year 1922, 15 yearlings were sold at an aggregate gross sum of £17,951, i.e., an average of £1,197, which, in view of the general fall in prices, may be considered satisfactory.

Both of the stallions at the Stud, "Silvern" and "White Eagle," had full subscription lists, and the performances of the stock of the mares at the Stud, which number 37, during the racing season of 1922 testify to the excellence of the brood mares.

GRADE "A" MILK.

A. T. LORAM.

In the July number of this *Journal* appeared an illustrated article on this subject, and the writer of the article asked and answered the question, Is Grade "A" Milk worth while? The present writer would like to add his emphatic "Yes" to that answer, and readers may be interested in the methods of another licensed producer of Grade "A" (Tuberculin Tested) Milk.

No season of recent years has had hotter spells than the summer now past. It has afforded an opportunity for proving that given *clean milk* there is no difficulty in keeping it sweet 36 hours and longer on the hottest thundery day. The conditions are:—

1. *Clean Cows*, groomed free of all dirt on flanks and udders. Teats and surrounding parts should be wiped clean with a wet cloth immediately before milking.

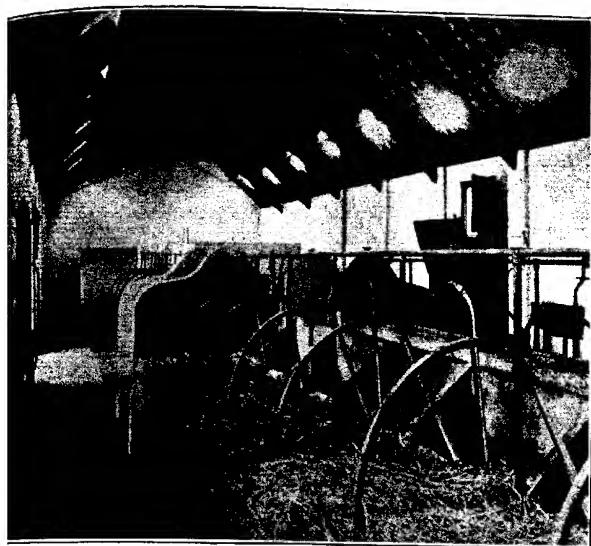


FIG. 1.—Cowshed for 30 Cows, with Bull Pen and Calf Stalls.

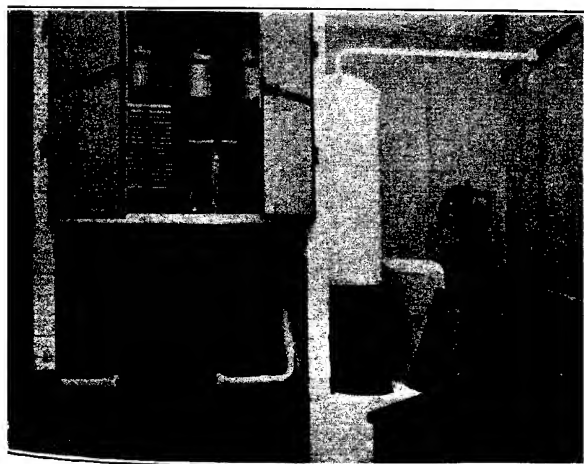


FIG. 2.—Sterilizing Room adjoining Milking Shed.



FIG. 3.—Showing the arrangement of the Milk Room.

2. *Clean Milkers* clothed in washable caps and overalls, using domed pails, clean stools, and washing their hands with soap and water between milking each cow.

3. *Clean Vessels* which have been sterilized by steam heat and kept in a dust-free chamber till needed.

4. *Milk Removed from Cow House* as quickly as possible, passed over a cooler and bottled immediately; or, if sent to a depot for bottling, covered in an airtight churn.

In these four conditions lie nine-tenths of all that is involved in high-grade milk production. Expensive cowhouses and fittings are not essential. At the same time good results are more easily obtained if the milking shed has an impervious washable floor and limewashed walls and ceiling.

The Cowshed.—The writer's cowshed is here shown (Fig. 1) The beds measure 5 ft. from the edge of the crib to the edge of the gutter; the width between divisions is 4 ft. 8 in.; the width of the gutter is 18 in., with a fall towards the path. Inside of these measurements big Devon cows find room and comfort, tied with the free-moving yokes shown in the picture. At the same time practically all droppings fall into the gutter free from the bed.

Sterilizing Room.—Adjoining the milking shed is the sterilizing room (Fig. 2). It contains a trough for washing milk vessels, and is used for nothing else. There is also a steaming block on which cans can be inverted, so that a steam jet reaches every crevice. A cupboard is arranged over the heating apparatus so that buckets, milk cooler, strainers, etc., can be thoroughly dried after steaming. The cupboard is frequently limewashed and is fly and dust proof. Doors are made of asbestos cement sheets on light iron frames. A 40-gallon cylinder provides abundant hot water which can be raised to steam at short notice with small consumption of fuel by an ordinary greenhouse stove. The one fire successfully meets all requirements.

Milk Room.—An inexpensive milk room is conveniently situated outside the cowshed, and yet not too far for the milkers to go. Fig. 3 shows the arrangement of it.

A dial and weighing bucket is suspended from the ceiling. At the top is an 8-gallon receiving tank with bead rim. Over this is stretched a sheet of thick straining material secured by a band of solid rubber (perambulator tyre) which is nipped into place with a lever such as is used for putting on motor tyres. A wide shallow stretch of strainer makes a better filter than a narrow deep one. From this tank milk falls slowly over the

cooler and thence into the churn beneath. A concrete platform 18 in. high makes convenient the lifting of buckets to the strainer. No dust-making operations or dung moving is allowed anywhere near while milking and cooling are being done. No dirt of any kind is allowed to accumulate near the milking shed. A cart stands in the yard to receive all sweepings, and this is removed to the fields daily. This and the use of a little chloride of lime now and then has reduced the fly population to a minimum.

As a result of care in details such as these, the writer has been able to get some very low bacterial counts when samples of milk are sent to Reading College.

Public Opinion.—Readers, however, will ask: Does the British Public think Grade "A" Milk worth while? To this a qualified answer must be given. Thinking people in increasing numbers appreciate the efforts of the Ministries of Health and of Agriculture to ensure the provision of clean milk, but it must be admitted that there is not a bewildering demand for it yet. The need of a Clean Milk Crusade is urgent, if for no other reason than because between leaving the cow and its consumption by humanity it is often sadly injured. A rousing demand for Clean Milk by the people of England, and a willingness to pay the little extra cost entailed in its handling, would be an encouragement to the farmer and a boon to the nation.

* * * * *

PIG-KEEPING.

II.

W. A. STEWART, M.A., B.Sc. (Agr.),
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Principles of Feeding; Constituents of Feeding Stuff;
The Albuminoid Ratio Method of Compounding Rations;
Notes on Feeding Stuff; Milk; Dry Feeding.

A KNOWLEDGE of the composition of feeding stuffs, together with some understanding of the functions in the animal body of the different food constituents, and of the needs of the animal when being fed for different purposes, is the only sound and economical foundation on which one can build up a system of feeding.

Principles of Feeding.—In addition to water, which is present in greater or less proportion in all feeding stuffs, chemical

research has shown that there are in foods certain other constituents or groups of constituents which are commonly described as follows:—(1) proteins or albuminoids, (2) fats and oils, (3) carbohydrates (starch, sugar, etc.), (4) mineral matter or ash. It had been assumed that these four groups alone represented everything essential for growth, development and the production of meat and milk, but this belief has had to be modified. Albuminoids supply the constructive material for the making of muscle or lean flesh and for the repair of tissues. In milk-producing animals, the albuminoids in the food supply the raw material for the albuminoids in the milk. If albuminoids are fed in excess of the animal's requirements, the excess may be utilised for supplying heat and making fat.

The fats or oils and carbohydrates are used for making fat and for the supply of body heat and energy. For this purpose it has been computed that 1 lb. of fat is as valuable as 2 to 2½ lb. of albuminoids or carbohydrates. A moderate quantity of oil in the ration aids digestion.

Mineral Matter.—It has been usual to regard the mineral matter as of value only for bone formation, but experiments conducted at the Rowett Research Institute by Orr and Crichton* have shown that this idea is mistaken. Ten or twelve minerals are now known to be necessary to keep the animal in health. They are present as essential constituents in the blood and soft tissues where they play an important part in the chemical and physical processes which take place, and they are necessary for the normal functioning of every organ in the animal's body.

The influence of mineral matter in feeding has not received as much attention as it would appear to merit. Experiments conducted in America have illustrated in a general way the importance of minerals, but there is an absence of exact and definite information on the matter. Certain practical conclusions, however, can be drawn with regard to lime† from the Rowett Institute's experiments. It was found that for proper growth and development a pig requires a supply of lime. The quantity required varies with the age and in proportion to the rate of growth, but ½ oz. per day of lime (CaO) may be taken as the average requirement of a three months old pig. The effects of insufficient lime are a slowing down in the rate of growth, a softening of the bones, and in extreme cases death. The cereal grains are poor in lime, but comparatively high

* *The Pig Breeders' Annual*, 1922.

† *Scottish Journal of Agriculture*, July, 1922, and *The Pig Breeders' Annual*, 1922.

in phosphates. Lucerne, clover and good grazing will supply a fair amount of lime. Fish meal and milk residues are rich in lime, phosphates, and the other essential minerals. It is quite possible, therefore, that a pig confined in a sty and fed on a mixture of cereal grains, may not receive sufficient mineral matter, and in that case, if milk is not available, some fish meal could be used to correct the deficiency.

McGowan and Crichton* have described a disease in young pigs, which occurred in a breeding herd where the sows were kept out in the open till within a fortnight of farrowing and then brought into sties with concrete floors, and fed on a mixture consisting of maize, brewers' grains and fish meal. The young pigs did badly and many deaths occurred. Certain characteristic symptoms were present both throughout the course of the disease and on post-mortem examination of cases. The investigators suggest that while the sows were at grass they were obtaining sufficient iron but after being brought indoors to farrow, owing to the conditions and the nature of the food the supply of iron ceased. The characteristic symptoms of the disease were attributed to iron deficiency, and large doses of ferrie oxide were given to the sows in their food with good results both as a preventive and as a cure for the disease. It would appear possible that iron deficiency may be a commoner cause of malnutrition in pigs than is generally recognised.

Vitamins.—We now come to the reason for the modification of the older assumption that albuminoids, fats and oils, carbohydrates, and mineral matter supplied all that was needed to maintain the animal body in health. Experimental evidence has shown that something more than those four constituents is required. In 1912, Hopkins published the results of his experiments with rats. He showed that on a ration of pure protein, sugar, lard and salts, young rats ceased to grow and ultimately died, but the addition of a very small amount of milk made a tremendous difference to their health and rate of growth. Other investigations have proved that there are certain substances which must be present in the diet of both human beings and animals, otherwise malnutrition and diseases occur. These substances have been called "vitamins" or "accessory food factors." We have at present no exact knowledge as to their form or composition as they have not yet been isolated in the laboratory, and belief in their existence rests entirely on the results of experiments, which have shown that on diets of

* Leaflet of the Rowett Research Institute, Bucksburn, Aberdeen.

purified food stuffs, certain diseases and symptoms occur, which either do not occur or disappear when certain substances are added to the ration. These substances are assumed to contain vitamins. From the results of further investigations, notably those conducted by Professors Drummond and Plimmer, it has been shown that there are at least three different vitamins which have been called A, B and C.

Absence of *Fat Soluble A* or Anti-Rachitic Vitamin results in cessation of growth and a susceptibility to infectious disease. There is some doubt as to whether rickets may be due to a deficiency of this vitamin. It is present in whole milk and in animal fats, particularly cod liver oil, and in green leaves. Cereals are low in this vitamin and such of it as may be contained in cereals is mainly confined to the germ and to the outer covering of the grain. Vegetable oils are low in it. Animals do not require much of Vitamin A to maintain health and they have the power of storing up a reserve supply. It is not readily destroyed by heat although prolonged exposure to high temperature will destroy it.

Water Soluble B or the Anti-Neuritic Vitamin is so named because of the symptoms of nervous disorder which occur when it is absent. The results of the deficiency of this vitamin were first seen in human beings in the East. Natives who live on polished rice suffer from the disease called beri-beri. Whole rice does not induce the disease and the reason would appear to be that Vitamin B is present in the outer covering of the rice grain and when the rice is polished, the vitamin is removed. In animals a deficiency of Vitamin B results in cessation of growth, in degeneration of the reproductive organs and symptoms of paralysis. Certain forms of lameness in pigs may be due to the same cause. Vitamin B is present in milk, eggs and seeds, particularly in the embryos of seeds, in leguminous plants such as clover and lucerne, and in dried yeast, cabbages, and potatoes. It is not affected by drying and not very readily destroyed by heat, though its potency would appear to be affected when it is subjected to high temperatures.

When *Vitamin C* is deficient, scurvy develops, hence this vitamin is called Anti-Scorbutic or Anti-Scurvy. In animals scurvy has certain characteristic symptoms—the appetite fails, the joints become swollen and tender and the animal is reluctant to move. This vitamin is present in milk, green leaves, particularly cabbage leaves, swedes, potatoes and most vegetables. Grains contain very little, but seedlings are rich in it. Vitamin C is readily destroyed by heat and also by drying.

Very little is known about how vitamins produce their good effects, and although experiments on smaller animals such as rats and guinea pigs have certainly shown that vitamin deficiency may have very harmful results, a word of caution is necessary, otherwise undue stress may be laid on it. Vitamins have formed a popular matter of interest, and a great deal has been written about them, with the result that their practical importance to the pig feeder may have become very considerably exaggerated. One should bear in mind the wide distribution of vitamins and the fact that comparatively small quantities are necessary for the maintenance of health. It is conceivable, however, that under certain conditions the pig may suffer from lack of vitamins. The pig grows more quickly than other farm animals and vitamins are particularly necessary for rapid growth. When the pig is confined to a sty and its diet is made up largely of cereal grains and commercial by-products without the addition of green stuff, roots and milk, there may be an insufficient supply of vitamins.

Fattening pigs do not suffer so readily as breeding animals. When breeding stock are kept in confinement for long periods, symptoms of malnutrition occur, which are probably due to vitamin deficiency, but under the open air system on grass or arable land crops, pigs are likely to find all the vitamins they require. At the Rowett Institute pigs on a ration containing only small but apparently sufficient quantities of vitamins showed as great gains per day and per pound of food consumed as those to which large quantities of vitamins were given. This result is in accordance with our experience on the experimental farm at the Moulton Farm Institute.

In the light of present day knowledge about vitamins, it is prudent to feed on a mixed diet, to include home grown feeding stuffs and green food, particularly leguminous crops, like clover and lucerne, or roots such as swedes, and potatoes. As is generally known, milk is a most valuable food, and this is partly due to its containing vitamins. It should not be necessary to purchase expensive animal oil or dried yeast preparations, for inclusion in the ration, with a view to supplying vitamins. The natural sources are much more satisfactory. Crude cod liver oil is sometimes recommended, but our experience has been that when even small doses were used, and its use discontinued altogether three weeks before killing, the carcass was tainted with the smell and flavour of the oil.

Suitable Digestibility and Bulk in the Pig's Ration.—

In addition to the fact that the ration should be properly

balanced in the matter of albuminoids, oil and carbohydrates, and should contain mineral matter and vitamins, it must be suitable with regard to digestibility and bulk. When the food appears in the dung in much the same state as when eaten, it has passed through the pig without being digested and without benefit to the animal. The pig has a simple digestive system, and it is therefore important that the ration should be comparatively easily digested. There should not be a large proportion of coarse fibrous material. Succulent green food is readily consumed by pigs, but as far as our data on the subject goes, it would appear that pigs digest only about 40 per cent. of the green food which they consume, as against 80 to 90 per cent. of barley meal and other suitable concentrated pig foods. In spite of this, it is sound and economical practice to feed green food provided that its cost is reasonably low. It is very doubtful, however, whether it is ever economical to allow pigs to depend entirely on green food as their sole diet. It is usually found better to supplement the green stuff with a small allowance of concentrated food.

The practical issue as between the outdoor and indoor systems of pig-keeping is not merely a matter of return in live weight increase for food consumed, it is a much wider question of farming economics, necessitating a broad view. It has been repeatedly demonstrated, however, that the open air system allows of more pigs being maintained conveniently on a commercial basis and ensures a healthier and more prolific breeding stock.

Nutritive Ratio.—It has been demonstrated by experiments and proved in practice that the most economical way to feed live stock is by compounding a ration so that it contains a certain quantity of digestible albuminoids in proportion to the digestible oil and carbohydrates. The proportion necessary varies according to the age and stage of growth of the animal; according also as to whether the animal is pregnant or barren; and according to whether it is giving milk or being fattened for slaughter. This proportion is called the albuminoid ratio of the food. When the albuminoid ratio of a food is suitable for the pig's requirements, 1 lb. of live weight increase should be secured from every 3 to 3½ lb. of meal consumed, but if the albuminoid ratio is not correct, then 6 lb. of meal may be required to produce 1 lb. of live weight increase. The albuminoid ratio of any food is obtained by multiplying the amount of digestible fat by 2.8 (because 1 lb. of fat is approximately

as effective as 2.3 lb. of carbohydrate), adding this to the percentage of digestible carbohydrates and dividing by the percentage of digestible albuminoids. Taking the average analysis of barley meal as follows:—

Digestible Albuminoids. per cent.	Digestible Oil. per cent.	Digestible Carbohydrate. per cent.
7	1.5	64
	1.5×2.3	= 3.45
		67.45

$$\text{The albuminoid ratio of barley meal} = \frac{67.45}{7} = 9.6$$

The following is a classification* of concentrated foods used in pig feeding, with their Albuminoid Ratio:—

GROUP I.—Foods Rich in Albuminoids, containing 30 per cent. or over.

Albuminoid Ratio.		Albuminoid Ratio.	
Fish Meal	1 : $\frac{1}{2}$	Decorticated Earth Nut Cake	1 : 1
Dried Yeast	1 : $\frac{1}{2}$	Linseed Cake	1 : 2

GROUP II.—Foods moderately Rich in Albuminoids, 17-30 per cent.

Albuminoid Ratio.		Albuminoid Ratio.	
Beans and Peas	1 : $2\frac{1}{2}$	†Dried Grains	1 : $3\frac{1}{2}$
Maize Gluten Feed	1 : $3\frac{1}{2}$	Coconut Cake	1 : 1
†Palm Kernel Cake	1 : $3\frac{1}{2}$		

GROUP III.—Foods Poor in Albuminoids (under 17 per cent.) and Rich in Carbohydrates (over 50 per cent.).

Albuminoid Ratio.		Albuminoid Ratio.	
†Bran	1 : $4\frac{1}{2}$	Wheat	1 : 7
Pollards	1 : 5	Barley	1 : $8\frac{1}{2}$
Maize Germ Meal	1 : 7	†Rice Meal	1 : 10
†Oats	1 : 7	Maize	1 : 11

*Based on the classification in "Feeding of Dairy Cows," by J. Mackintosh.

†Foods fairly high in fibre and of only moderately good digestibility.

Feeding Standards for Different Classes of Pigs.—The approximate ratios found to be suitable for pigs are as follows:—

Albuminoid Ratio.		Albuminoid Ratio.	
Little Pigs, 3-6 weeks old ...	1 : 4 to 5	In-pig gilts and sows ...	1 : 6
Young Pigs, 6-12 weeks old ...	1 : 5 to 6	Sows in milk ...	1 : 5
Fattening Pigs ...	1 : 6 to 8	Stock Boars ...	1 : 5

It is not suggested that these figures are mathematically exact, but at the present stage of our knowledge of feeding they form the most useful and simple scientific check on rations which we have. For the past two years we have made up our rations for the commercial herd of pigs on the Experimental Farm on this basis, and after trying other methods of checking, such as estimating the digestible protein and starch equivalent and the total number of food units, we have abandoned those in favour of the simple albuminoid ratio check. Close observation of the results has shown the latter method to be sufficiently accurate for practical purposes. It will be clear that in making up a ration, one would look to Group I or Group II to find the

requisite albuminoids. The foods at the top of Group III, *e.g.*, pollards, are well balanced. Pollards have long been known as a safe food for young or breeding stock, whereas those at the bottom of Group III are essentially fattening foods.

Notes on Feeding Stuffs. Group I.—Fish Meal.—It has been found that fish meal has a special value in feeding pigs. This may be due to the nature of its protein and its high content of mineral matter. Pigs apparently require some protein of animal origin and this can be supplied in the form of fish meal, meat meal or dried blood. The two latter are somewhat dangerous on account of the risk of disease. It is generally believed that 10 per cent. of fish meal will supply all the mineral matter required by the pig. In order that the carcass may not be tainted with the smell and flavour of fish, it is most important that a good brand should be used and that the quantity should not exceed 10 per cent. of the ration. A good brand of fish meal should not contain more than 4 per cent. of oil or 3 per cent. of salt and should be guaranteed as made from sound white fish only. An additional safeguard against tainting can be secured by discontinuing its use during the last fortnight or three weeks of fattening.

Dried Yeast.—In addition to being rich in albuminoids, dried yeast contains the Vitamin B. In use it has the rather serious drawback that it sets up fermentation when mixed with anything of a sugary nature.

Decorticated Earth Nut Cake should only be used in small quantity and for adult pigs, as it is apt to cause scouring.

Linseed Cake.—At the rate of about 10 per cent. in the ration, linseed cake is a most valuable food for maintaining health and producing "bloom" of coat and skin. If very rich in oil and fed in fairly high quantities to sows in milk it is liable to cause the little pigs to scour. Used in excess of 10 per cent. to fattening pigs it may produce a soft yellowish fat.

Group II.—Beans and Peas are the two home-grown foods richest in albuminoids. Both have a somewhat binding effect and should not exceed a quarter of the ration.

Maize Gluten Feed is a by-product from maize. It is a good pig food without any apparent bad effect on the pork or bacon.

Palm Kernel Cake is now fairly extensively used. It is usually cheap but it is not a high class feeding stuff and is rather unpalatable and not very highly digestible. It should not be fed to young pigs, and should never exceed 20 per cent. of the ration. Palm kernel meal (extracted) is an inferior food.

Dried Grains in small quantity not exceeding 10 per cent. help to stimulate milk production in sows. As a food, however, they are rather fibrous and of low digestibility.

Coconut Cake is fairly similar to palm kernel cake. It will soak up very large quantities of water. It is quite a useful feeding stuff if not used in too high proportion in the ration.

Bran contains a good deal of fibre and on that account should be limited to 10 per cent. of the ration. It has a mild medicinal action and when fed wet acts as a laxative. It is good for sows just before and after farrowing as it prevents constipation and stimulates milk production.

Pollards are too well known to require comment. They form the safest pig food that we have.

Maize Germ Meal should consist of the germ of the maize grain. It has a high oil content and is therefore slightly laxative. If used in excess the oil may have a harmful effect on the carcass.

Oats contain so much husk that they are not specially suitable for pig feeding. If the husk can be got rid of, the oat meal forms a wholesome feeding stuff.

Wheat is best used in small proportion mixed with other feeding stuffs. If used too liberally it makes the ration pasty and sticky, causing indigestion.

Barley is the staple fattening food. It is highly digestible.

Rice Meal is high in oil and fibre. If used in quantity it produces rather an inferior type of carcass. It is low in mineral matter and this possibly explains the common belief that rice meal causes lameness.

Maize is very starchy and forms a fattening food. If used in excess it produces a type of carcass which is strongly objected to by bacon curers. The lean of such a carcass is not of good quality and the fat is soft and oily.

Milk.—Whole milk is a nearly perfect food and is almost entirely digestible. Separated milk, which is more commonly used in pig feeding, is invaluable for young pigs and sows in milk. As most of the fat has been removed it has a slightly binding tendency. Some of the Fat Soluble A vitamin has been removed but the other vitamins are still present along with the mineral matter. One gallon of separated milk is roughly equivalent to 1 lb. of digestible mixed meal.

Whey is milk from which the greater part of the fat and proteins have been removed. $1\frac{1}{2}$ gallons of whey would be roughly equivalent to 1 gallon of separated milk or 1 lb. of digestible mixed meal.

Dry Feeding.—Dry Feeding has been under trial and investigation on the Northamptonshire Experimental Farm, Moulton, since July, 1922, and the results obtained here and elsewhere would appear to indicate that dry feeding is likely to play an important part in the economics of pig-keeping in the future. The established system of feeding wet food, in a more or less liquid condition, entails much labour where pigs are kept on a commercial scale. Unless the pig attendant is thoroughly skilled and highly intelligent, the quantity of water in the food is not varied as it should be according to the pig's requirements, especially as affected by weather and atmospheric temperature, with the result that in cold weather pigs are frequently forced to consume more water than they either need or want, while in warmer weather they may not receive enough. With dry feeding and the provision of a constant water supply in the pen or run, this most important matter is controlled by the pig itself. The pig drinks just what it requires, and this is a most vital point in feeding both in the matter of health and development.

Digestive troubles and colds, which frequently occur in winter and develop readily into pneumonia or other lung affections, can often be traced to giving too much water under the wet feeding method, and the chill to the system which this entails. Our experience and observations confirm the opinion that such disorders are less common with dry feeding. With an efficient type of feeder, the food is always quite sweet, and for young pigs in particular this is a very important detail. Sour food is one of the commonest causes of illness. Pigs when dry fed, masticate their food. Mastication is the first process in efficient digestion. Efficient digestion and absorption should mean that less food is required to produce 1 lb. of live weight increase.

The practice of dry feeding goes best with the open-air system of pig-keeping. It can, however, be practised in yards or pens, but it is important that dry fed pigs should have adequate facilities for exercise.

It has generally been found advisable to allow an unlimited ration to fattening pigs, and to young pigs up to the age of about 16 weeks. When this is done the feeder can be filled up to its capacity and the pigs allowed to help themselves. It is therefore unnecessary to provide feeding accommodation so that all the pigs concerned can feed at one time. A feeder which will accommodate say 12 pigs at a time will be sufficient for a bunch of three or four times this number, and even the smallest and most weakly pigs will have ample opportunity of feeding,

as all the pigs will not want to feed at once. For breeding stock the limited ration is the most satisfactory method. When limited to a few pounds a day, it is necessary to put the whole ration in the feeder once daily, or to halve it—putting half in in the morning and half in the afternoon. When limited rations are used, sufficient feeding space for all the pigs to feed at one time will be required. Even where the food is given in two portions daily there is saving of labour compared with the wet method of feeding.

In-pig sows up to three weeks before farrowing have done extremely well on 2 to 3 lb. of dry meal per day in winter and less in summer, together with green stuff, roots or potatoes. When potatoes are fed in quantity it is necessary that the meal should be specially rich in albuminoids. On a modified open-air system, for stores and breeding stock, including sows up to shortly before farrowing, dry feeding is satisfactory and economical.

In the case of fattening pigs, there is considerable difference of opinion. Such experiments as have been carried out are hardly conclusive. It is essential that the pigs should not be allowed to become costive. To prevent this they must receive either green food or roots, or the ration itself must be sufficiently laxative. This has been secured here by the inclusion of a small percentage of crushed linseed or linseed cake.

In practice, when preparing pigs to be sold as medium pork (100-120 lb. dead weight) and for bacon (140-170 lb. dead weight), it has been found satisfactory to run the pigs on arable land crops on dry food, and then to have them in yards at the farm buildings for the last three or four weeks before disposing of them, and to feed them on wet food. It is a convenient time to discontinue the use of fish meal when the pigs are put on the wet food. This ensures that there is no possibility of the carcass being tainted.

Dry Feeders.—A dry feeder should have the following qualifications:—(1) It should protect the food from wind and rain and from birds and vermin; (2) it should be possible to regulate the supply of food so that it will run slowly from the hopper and not accumulate in the trough; (3) it should be easily movable; (4) it should be as simple as possible in construction; (5) it should be durable and not easily broken or damaged, moved or upset by pigs. After extensive trials with the principal makes, we have not yet found a perfect dry feeder.

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THE CULTIVATION OF SUGAR BEET.

ALFRED WOOD, F.C.A.,

*Secretary of the British Sugar Beet Growers Society and
Secretary and Assistant Secretary, respectively, of the
Kelham and Cantley Beet Sugar Factories.*

Nature of the Crop.—The sugar beet is a root plant of the same family as the mangold. Properly cultivated it is a long tapering root, of a shape and colour similar to a parsnip, but larger and broader at the top (Fig. 1). Its weight, excluding the crown and leaves, averages from $1\frac{1}{2}$ to 2 lb. If through shallow cultivation it develops fangy roots it loses in sugar content. It has a heavy green foliage. Unlike the mangold it grows almost entirely below the surface. The beet develops innumerable rootlets and root hairs, absorbing water and plant-food to feed the plant, which permeate and ventilate a wide radius of soil (Fig. 2). These are detached in the act of lifting the beet.

Sugar Content.—Formerly the sugar beetroot (or white mangold) only contained 6 per cent. of sugar, but after selection of seed over many years the plant now produces and stores in the root from 15 to 20 per cent. of its net weight of sugar. All commercial seed used in sugar beet cultivation for the production of sugar is grown from "mother seed," which is carefully propagated from year to year at seed producing stations under the control of scientists trained in this special branch of the work. If seed were grown the second year from the commercial sugar beet the plant would be inclined to "throw back," and the beets grown therefrom would be of no value for sugar production. The sucrose or sugar in the beet is the product of air, light and water. It is produced in the leaves and stored in the root. When the leaves have done their work they become greenish yellow and wilt. The top or crown of the root (from below the lowest leaf or bud) is removed on the field (Fig. 1) as it contains the smallest percentage of sugar and the greatest amount of impurity. It is therefore useless for sugar extraction, and is in fact harmful to the manufacturing processes.

Climate.—It has been proved that the climate of England is eminently suitable for the crop. This was amply shown in the bulk cultivation of beet which took place during the exceptionally sunny but dry season of 1921, and the correspondingly wet and sunless season of 1922. In both these years the sugar

content in the beet averaged over 16 per cent. The Eastern Counties of England most resemble the chief beet-growing districts of the Continent, but satisfactory crops of beet have been grown in most parts of this country south of the Humber, and there is no reason to suppose that the crop might not be successfully grown still farther north.

Soil.—The best soils are deep loams, well supplied with lime and organic matter. Any free-working soil, however, adapted for growing roots, barley or potatoes should grow beets well. Even with strong clays the beet can be made to thrive with liberal treatment of the soil, the main objection being the

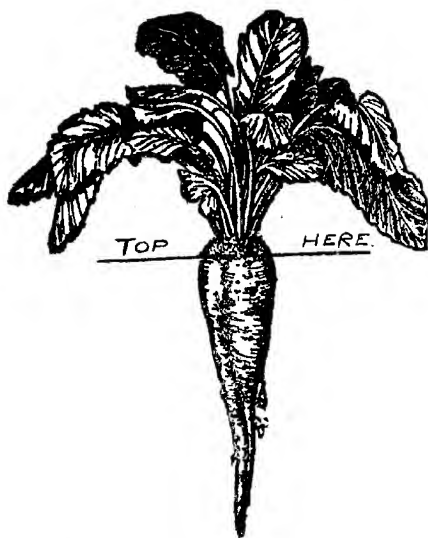


FIG. 1.—A typical Sugar Beet, showing correct Method of Topping.

increased labour in lifting a deep root, although a high sugar content is usually obtained. Very shallow soils should not be used. Instead of a long tapering root, the beet takes a mangold shape and develops fangy roots. Deformed roots are also caused by insufficiently drained soil.

Rotation.—Sugar beet can be grown several years in succession on the same land, but this is not recommended. Each year the crop becomes lighter and is more liable to attack by pests, especially if the tops and leaves have been ploughed in. It is more economical to grow the beet crop as the

cleaning crop in the rotation, replacing mangolds, swedes or common turnips, to be followed by wheat, oats or barley and seeds. It is sometimes taken after a root crop, after a clover ley broken up early, or after peas or beans. There is no hard or fast rule for the place of sugar beet in the rotation. The farmer will decide, as with his other crops, according to the specific conditions of his own farm.

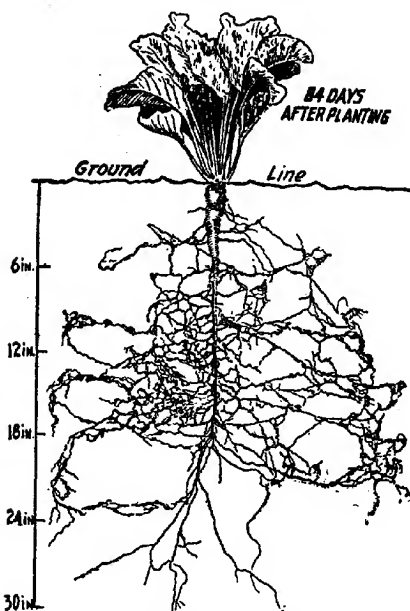


FIG. 2.—The Sugar Beet's Action on the Soil during growth.

Cultivation.—The cultivation of the beet crop is similar to that required for mangolds. *Deep working is essential* in the case of sugar beet. Preparation should take place as soon after harvest as possible. As soon as the cereal crop is clear of the field, weed and other seeds begin to grow, and their growth can be encouraged by light cultivation, not more than 3 in. deep, by skim plough or cultivator. After fourteen days to three weeks the land should be thoroughly cleaned of surface rubbish. Farmyard manure (10 to 12 tons per acre) is then carted on and ploughed in deeply to a depth of 10 in. or more and the land then left to be pulverised by the winter frosts. This would avoid spring ploughing, as a friable soil will be secured which

should be well worked in April in time for sowing. The roots must be given every opportunity of going deep. The under soil must therefore be thoroughly pulverised, while the upper soil should be more compact so as to give a downward direction to growth.

Manuring.—Practically all the manure in the rotation is applied to the sugar beet crop, *the succeeding crops requiring no manurial assistance.* The beet crop will not exhaust the soil and the manuring together with the thorough cultivation improves and cleans the land for the succeeding crops.

The sugar beet uses relatively large quantities of potash, but not so much nitrogen or phosphoric acid. Nitrogen stimulates the leaf growth. Potash is closely associated with the formation of sugar in the leaves. Phosphates are required less for the production of beets than for the formation of seed, which is not required in beet cultivation for sugar production. Beets which run to seed in the root year are starved in sugar content, and are useless for sugar manufacture. They should be taken out as they appear. They should never reach the factory as they are injurious to the working of good roots.

In general the manurial treatment required for a successful beet yield is that usually applied to secure a good potato crop. This will vary in different localities according to the nature and condition of the land, and the manuring of preceding crops. The experienced grower will manure his land according to his intimate knowledge of his own farm, making comparative tests to secure the best results, and no two growers will be found to act exactly alike in this respect. The following examples are therefore given with reserve, merely as an approximate guide to the new grower as to the relative values of the different manures on all soils, the quantities, in actual practice, being increased or reduced according to the condition of the land and the variations of the soil :—

	1. Heavy Soils	2. Medium Soils	3. Light Soils
Farmyard Manure	10 to 12 tons	10 to 12 tons	10 to 12 tons
Lime	1 cwt.	2 cwt.	2-3 cwt.
Phosphates (30 % to 35 %) ...	6 cwt.	4 cwt.	2 cwt.
Potassium Salts (20 %) ...	1 cwt.	3 cwt.	5 cwt.
Sulphate of Ammonia ...	1 cwt.	1 cwt.	1 cwt.
Nitrate of Soda	1½ cwt.	1½ cwt.	1½ cwt.

The farmyard manure and lime should be applied in the autumn, the phosphates (unless in the form of basic slag) and the potash in the spring. The sulphate of ammonia should be harrowed in when preparing the seed bed, and the nitrate of

soda should be used as a surface dressing in two parts, half after the first hoeing and the rest after the singling has been completed.

Drilling.—Seed is always supplied by the factory at cost price, and only beets grown from this seed are accepted. It is not possible to lay down a fixed date for drilling, as weather conditions vary from year to year. As the factories require some of the beet of each grower early in October, it is advisable for a grower to drill part of his acreage not later than the middle of April, but it is wise not to sow earlier. If sown earlier the early mild weather encourages growth, and if the later colder weather brings growth to a standstill for a time, the roots may then develop a tendency to run to seed. Early drilling will always enable a grower to re-drill if a satisfactory plant is not obtained at the first drilling. Where a large area is grown by a farmer, he should drill at three different times at intervals of 10 to 14 days. The beets will not then require singling or hoeing at the same time, and as they also do not ripen at the same time the average sugar content at delivery is kept higher because the factory requires deliveries for manufacturing in equal quantities during the season from 1st October to 20th December. *A good seed bed is essential.* A faulty seed bed is often the cause of patchy fields of plants. Drilling in a well-prepared seed bed gives the most successful results if the drilled rows are slightly pressed down by small rollers fixed behind the coulters. This has the advantage also of indicating the drilled rows, and a first hoeing can be done if found necessary even before the plants appear. The seed should be drilled on the flat in rows from 16 to 18 in. apart, preferably 16 in., and not more than 1 in. deep. Not less than 15 lb. of seed per acre should be drilled; abroad as much as 25 to 30 lb. are drilled. It pays to be generous with seed. This reduces the risk of poor germination and of plants being attacked by pests. It gives greater scope for securing a good "stand," that is to say, the number of good plants per acre, and thus avoids a "thin" crop. If the plant is not coming up evenly the germination can usually be assisted by rolling, preferably across the rows. If the rolling is done early in the morning it helps to keep down pests.

Hoeing.—Success in sugar beet cultivation depends very largely on the singling (thinning) and hoeing of the sugar beet crop. The object is to cause all the efforts of growth to be concentrated upon the best plants which are being isolated to

create the sugar. Horse-hoeing should be done early, thoroughly and continuously until such time as it is no longer possible, owing to the rows being covered by the leaves of the plants. It should be commenced as soon as the plants in the row reveal themselves. Light draught horse hoes as used in America and Denmark are recommended. They are fitted with protecting disc coulters for the first early hoeing, replaceable by duck foot and angle tines as required. They are capable of hoeing four rows at a time, and the tines can be adjusted by the driver to allow for any irregularity in the rows. As the leaves are the sugar-producing agent care should be taken not to damage them. In hoeing, the roots, unlike mangolds, should be kept covered by soil. Uncovered roots lose sugar content. Hoeing must be maintained not only by the horse hoe between the rows, but by the hand hoe between the plants in the row. The beet crop compels the constant cleaning of the land from the moment drilling is started until the harvest begins. It necessitates special attention to the loosening of the soil between the plants. This allows light and air to penetrate the soil to the benefit of succeeding crops. Foreign experience has proved the value of this.

Singling.—When the plants show *four leaves* they should be carefully singled. Singling consists of two operations. First, bunches of plants in the row are isolated by chopping out with a hand hoe all intermediate plants between each bunch so that the bunches are 12 to 14 in. apart. The chopping-out should be at least 1½ in. deep to clear away any seed not yet germinated, and the block should not be more than 1 in. wide. On the black fen lands, where beets are inclined to grow big and coarse, a higher sugar content will probably be obtained if the plants are singled 8 in. apart. The actual singling takes place by loosening the soil in the bunch so that the plants fall apart, holding down the best plant it is intended to leave and removing all other plants and weeds in the bunch. Singling is usually paid for at piece-work rates. An experiment conducted in Germany showed the following results:—

<i>Time of Singling</i>						<i>Yield in Tons</i>
At the proper time	...	...	...	...	...	15 tons.
One week later	...	...	...	...	...	13.5 "
Two weeks later	...	...	...	...	...	10 "
Three weeks later	...	...	...	...	...	7 "

It is therefore clear that the yield per acre and the percentage of sugar content depend very largely upon early and proper singling.

Moisture.—A good root, that is to say, a long single root without fangs, produces the highest sugar content, because its storage qualities are the greatest. In addition, it more readily withstands drought, as it reaches down more deeply for moisture than the shorter or deformed roots.

Pests.—The sugar beet plant has been found to be less subject to attack by the mangold fly and other pests than the mangold plant.

Harvesting.—Ripeness is indicated by drooping of the leaves and their changing to a yellowish-green colour. About three-quarters of the foliage should have wilted, but the central leaves should still be fresh and green. Lifting is done by two operations. A beet lifter (Fig. 3) is used to loosen the beets from the soil surrounding them. They are then pulled out by hand, two at a time, knocked together to remove as much soil as possible, and laid in rows or thrown into heaps.

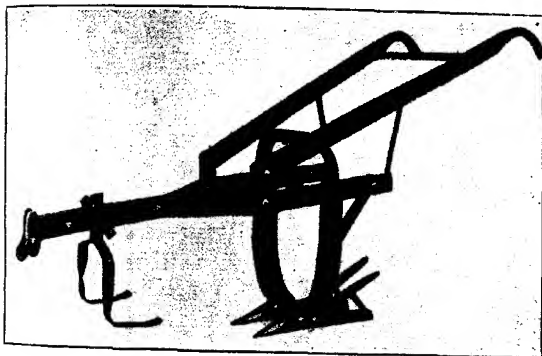


FIG. 3.—A Sugar Beet Lifter, adjustable for large or small beets.

Topping (Fig. 1) is best done by one blow of a heavy knife. Unless carting is done promptly the heaps should be covered with the tops and leaves to avoid reduction of sugar content through frost or the action of the sun. When there is danger of frost they should be clamped like mangolds. Beets do not suffer from the frost before lifting. They should be thrown into the carts with beet forks (Fig. 4) having prongs with small globular ends which do not pierce the beets.

Tops and Leaves.—The tops and leaves should be left on the field. They are equal in weight to 75 per cent. of the root when topped. If ploughed in they are of considerable manurial

value, but may assist in giving new life to parasites, animal and vegetable, which live on beets, if a beet crop follows on the same land. In foreign countries they are considered of greater value if used for feeding direct off the land for cattle, sheep or pigs. It is customary abroad in the autumn to take the tops and leaves to the fields where cattle are still grazing, as they cause a heavy milk flow. They are also ensiled to serve as a winter food. They should never be fed wet or dirty, and should be used carefully as they have a somewhat laxative effect.



FIG. 4.—A Fork for handling Beets.

Yield.—The yield varies according to the land on which the beets are grown as well as the care taken in preparing the land and in the after-cultivation. A fair average crop is 9 to 12 tons of washed and topped roots. Some districts, such as the Fen country, can produce crops up to 14 or 18 tons. The lighter crops often give a comparatively greater percentage of sugar content.

Sugar Beet as a Cattle Food.—The sugar beet is used mainly for conversion into sugar and is most profitably disposed of to

a factory, but it can also be used as a food for stock. *In cases where a trial crop is grown which cannot be sent to a beet sugar factory, the crop may be fed as follows:—*4 lb. of sugar beet (as topped) may be substituted for 8 lb. of mangolds or 1 lb. of cereal meals in a mixed ration. 20 to 30 lb. may be fed daily to dairy cows, as much as 50 lb. to fatting cattle, 10 lb. upwards to young cattle, and 10 lb. downwards to calves. For pigs, 1 lb. of barley can be replaced by from 4 lb. to 8 lb. of sugar beet in a mixed ration. The use of the whole sugar beetroot as a food for stock has no special value as compared with mangolds, though they are particularly suitable for pig feeding. On the other hand, the value of the tops and leaves and of the dried sugar beet pulp from the factory for this purpose cannot be over estimated.

Delivery to the Factory.—The price paid by the factory is a delivered price per ton of washed and topped beets and varies according to the sugar content in the root, as ascertained by the factory chemist. A calculation is made of the percentage of tare delivered by the grower in a fair sample which is washed and re-topped (if necessary). It is therefore to the grower's interest (a) to top correctly, and (b) to send the roots as free from dirt as possible, as he will be paying carriage upon weight for which he does not receive payment. The roots are washed at the factory and not by the grower. As the sugar content is ascertained from a sample of the roots in the form in which they enter the factory, and as the top contains a negligible amount of sugar, if the grower does not top properly, he will also reduce the proportion the sugar content bears to the weight of the whole root. This is important to him in its effect upon his price. If his yield is low through inattention to the points set out above, he will reduce his profit per acre, as he is paid according to the actual net tonnage delivered. He should also fully load the railway trucks, as the carriage rate for beet is fixed upon a minimum load of six tons. Otherwise he will again lose through excessive carriage charges.

By-Products.—The grower is always allowed, under the beet contract, to purchase back from the factory up to 5 per cent. of the net weight of beet delivered in dried beet pulp at the special price stated in the contract. This product is the main by-product of the factory and is a valuable food for stock, increasing the yield of fattening cattle and the milk flow of dairy cows. He is thus enabled to return to his land what the sugar beet crop has taken from it, and the dried pulp acts as

a substitute for the mangolds or swedes he would otherwise have grown for consumption on his own farm. This completes the agricultural circle, as it were, so that he has only taken from his land the sugar which has not drawn upon its fertility. On the contrary, the land has been made more productive for the crops following in the rotation. In foreign countries it has been proved that sugar beet increases the yield of the corn crops that follow by 10 to 15 per cent., and farmers are now beginning to testify to similar results in this country.

The Growers' Return.—In 1922 the factory offered 32s. per ton of washed and topped roots put on rail. In addition, 2s. was added or deducted proportionately for each 1 per cent. of sugar content above or below $15\frac{1}{2}$ per cent. The average sugar content over the whole crop was slightly over $16\frac{1}{2}$ per cent., so that the average return to the farmer was 34s. per ton on rail. Though costs of growing varied in different districts and according to the experience of the grower or his labour, it was acknowledged generally by the growers that their beet crop yielded a very satisfactory profit. For 1923 the price is 40s. per ton of beet delivered at the factory. There is again a variation in price if the sugar content is above or below $15\frac{1}{2}$ per cent., 2s. 6d. being added or deducted proportionately for each 1 per cent. above or below that basis. There is, however, in 1923 a further variation according to the average sale price of sugar realised by the factory; 1s. per ton of beet is added or deducted proportionately for each 1s. or fraction thereof in the price of sugar above or below 40s. per cwt. The price of sugar at present is 54s. 6d. per cwt., so that if this be the realised price and the grower secures an average sugar content similar to that of last year, viz., $16\frac{1}{2}$ per cent., he would receive a return of 57s. per ton of washed and topped roots delivered at the factory. Allowing for a probable fall of 5s. per cwt. in the price of sugar, he would still receive 52s. as a delivered price, and as the average carriage, having regard to recent reductions in the rates, will probably be 5s. per ton, he would then receive 47s. per ton on rail for his beets instead of 34s. last year. Further reductions often accrue through delivering to the factory direct by cart or lorry, thus saving railway freight and one handling.

Cost of Production.—With regard to the cost of production, detailed costs are often misleading and can never be ascertained with accuracy for purposes of average, yet it is generally found that the total cost, whatever the variation in specific items

may be, approximates the same figure. From inquiries as to experience to date, the British Sugar Beet Growers' Society came to the conclusion that £15 might be considered as a fair average cost under present conditions of growing an acre of beet and putting the produce on rail. In some cases, however, the cost has not exceeded £12. It was also found that as the greater portion of the cost of a crop of beet consists of labour, considerable economies are possible as the grower becomes more experienced. Taking specific districts, however, such as the Spalding area, the cost per acre might reach £20, but the grower, as a rule, secured a much greater yield, which has more than compensated for this additional cost. The Society also found that the average yield under normal conditions might be taken at 10 tons per acre, although on account of certain special circumstances there was a lower average yield last year, and although in the previous year, in the areas serving the Kelham factory, the average yield was higher. An acre yielding 10 tons of beet might therefore be considered to cost not more than £15, and might cost not more than £12. This gives the cost per ton of beet at 24s. to 30s. per ton on rail, and with a greater yield a lower cost still. For this reason it is desired to emphasise the importance of the notes on hoeing and singling. Each ton of yield lost through unsatisfactory cultivation seriously reduces the growers' profit.

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DATES OF BLOSSOMING OF APPLES AND PEARS.

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Ministry of Agriculture and Fisheries.

THE growing of apple trees in this country has occupied the attention of many people for hundreds of years, but few have been sufficiently interested to carry out annual observations and record systematically the behavior of the different varieties. Possibly trees are not favoured for observation work for the reason that results can be obtained but slowly and hold out little promise of completion in any one lifetime. The choice of such a plant would only be made by one possessed of great patience, and with little desire to push matters with great speed. All workers on pomology are aware of this and will appreciate the work which has been done by Mr. James

Udale, the experienced horticulturist of Worcestershire, whose observations on fruit trees have been made over a period of 20 years, and the work of Mr. Cecil H. Hooper, who has worked out statistics and averages to utilise Mr. Udale's records of the blossoming and fruiting of many varieties of apples, pears and plums. The chances afforded to Mr. Udale do not come to all. He established, in 1896, an experimental fruit plantation at Droitwich for the Worcestershire County Council, and was thus able to start his work early in the life of a new plantation and to continue to record the behaviour of these trees as they grew and came into bearing. The records commenced in 1896 and were completed in 1920. For the purpose of Tables I and II the figures for the first four years have been omitted.

Particular attention was given each year to the dates of flowering of different varieties and to the yield of each individual tree. The figures for yield can be of less use or importance for permanent records chiefly because of the varying factors in each locality which influence the crop. Some factors vary with every plantation and constitute a great uncertainty in the problem. Nevertheless the crop records are not without their interest and use, if their limitations are accepted and properly understood. The records of the date of blossoming are of more value, though even in this case there is a little uncertainty as to the influence of the stock on the date of flowering, and it is feared that information is lacking as to the type of stock used in the Droitwich gardens.

Apples.—There is a tendency for growers, at the present time, to limit the number of varieties of fruit to a few commercial kinds, which for trade reasons is both desirable and necessary, but as this may lead to the planting of large blocks of varieties the flowers of which are self-sterile, or are self-fertile to only a small degree, it becomes necessary for the planter to have accurate knowledge both as to the degree of self-fruitfulness and as to the period the variety is in blossom. With the self-sterile and partially self-sterile varieties such as Beauty of Bath, Cox's Orange Pippin and Grenadier, it becomes necessary to plant varieties which can serve as "mates" or pollenizers, and an important matter of this kind should not be left to chance. The pollenizer can only be of use if its pollen is ready when the flowers of the self-sterile variety are ready to receive it, and thus it is necessary to plant varieties with a common flowering period, or, at any rate,

varieties with flowering periods which overlap considerably. Mr. Udale found with apples that the longest period between the blossoming of the earliest and the latest varieties was 81 days, which is a very considerable range, but that the average range was about 16 days.

The records from Mr. Udale's observations are shown in Tables I and II, from which the order of flowering of the varieties can be seen. Based on these records and those obtained by observers in other parts of the country, the order of flowering is placed as follows:—*

Earliest - Irish Peach (F1), Warner's King (F2), Bismarck (F3).

Early - Beauty of Bath (S), Stirling Castle (F1).

Mid-Season James Grieve (F3), Gladstone (F3), Allington (F2), Rival (F2), Cox's Orange (S), Early Victoria (F1), Bramley (F3), Lord Grosvenor (F1), Ecklinville (F2), Worcester Pearmain (F3), Grenadier (S or F3).

Late - Lord Derby (F1), Lane's Prince Albert (F3), Newton Wonder (F3), Annie Elizabeth (F3), Lady Sudeley (S or F3), Blenheim Orange (S).

Very Late - Royal Jubilee (S).

Mr. Udale's and Mr. Hooper's records will also be of use in assisting growers situated in exposed places or in places subject to late frosts, to select varieties which come into blossom at less dangerous periods. The varieties of apples that ripen first do not necessarily blossom first, for Mr. Udale found that the very late dessert apple, Sturmer Pippin, flowers early

TABLE I.
Average Order of Blossoming and Yield of Apples at the
Worcestershire Experiment Garden, Droitwich,
1900 to 1920.

Variety.		Yield in 21 years. lb.	Average yield per tree per year in lb.
Bismarck	bush	1,340½	64
Stirling Castle	bush	1,481	70
Sturmer Pippin	bush (2 trees)	1,590½	38
Lord Grosvenor	bush (3 trees)	5,154½	82
Ecklinville Seedling	bush (3 trees)	3,802	60
Mr. Gladstone	bush	305	14
Worcester Pearmain	bush, unpruned	1,715	81
Cox's Orange Pippin	bush	466½	22
Bramley's Seedling	standard	3,176	151
Lane's Prince Albert	bush	3,557½	169

* The letters after the names of the apples and pears signify that the variety is (S) self-sterile, (F1) partially self-fertile, (F2) occasionally self-fertile, (F3) very rarely self-fertile.

whereas Gladstone, one of the earliest dessert varieties flowers fully a week later. The exact date at which the trees burst into blossom largely depends on the weather of the year. Generally, the end of April to the middle of May would be the average for the Midlands, but Mr. Udale found in 1914 that the period during which the earliest and latest apples began to blossom was 17th April to 29th April, and in 1920, 11th April to 2nd May. In other years it was later. The order of blossoming of the different varieties is perhaps the only satisfactory way of collating these records.

Pears.—With pears the interval between the date of blossoming of the earliest and latest blossoming varieties, as recorded by Mr. Udale in Worcestershire, was from 9 to 35 days, with an average of 12 days difference, whilst in Kent, Mr. Hooper found the range to be 13 days in 1908 and 18 days in 1909. Jargonelle and Beurré d'Amanlis were the first to flower and Doyenne du Comice amongst the last, so that the chances of either of the former pollinating the self-sterile Comice would be small in normal years. Winter Nellis, Clapp's Favourite, or Marie Louise, which flower only slightly in advance, should provide suitable pollen for Comice.

TABLE II.

Average Order of Blossoming and Yield of Pears at the
Worcestershire Experiment Garden, Droitwich,
1900 to 1920.

Variety.		Yield in 21 years. lb.	Average Yield per tree per year in lb.
Beurré d'Amanlis	standard	1,893	90
Maréchal de Cour	bush	447½	21
Louise Bonne of Jersey A	bush	523	25
Louise Bonne of Jersey B	bush	750	36
Durondeau	bush	934	44
Beurré Superfin	bush	467	22
Marie Louise d'Uccle	bush	1,882½	90
Beurré Hardy	bush	1,256	60
Williams' Bon Chrétien	standard	1,189	56
Fertility	bush	4,706	229
Pitmaston Duchess A	bush	723½	34
Pitmaston Duchess B	bush	1,379	66
Clapp's Favourite	bush	1,161½	55
Winter Nellis	bush	219½	10
Marie Louise	bush	758½	36
Doyenne du Comice A	bush	1,140½	54
Doyenne du Comice B	bush	996	47

The records of Mr. Udale are set out in Table II. Mr. Hooper, from these and other observations made in the south, places the varieties in the order of flowering as:—

Earliest - Jargonelle, Doyenne d'Été.

Early - - Beurré d'Amanlis (S), Conference (F2), Marguerite Marillat (F2), Beurré Clairgeau (S), Durondeau (F3).

Mid-Season Louise Bonne of Jersey (S), Emile d'Heyst (S), Clapp's Favourite (S), Marie Louise d'Uccle (S), Fertility (S), Catillac (S).

Late - - Hesse (F3), Beurré Capianmont (S), Dr. Jules Guyot (F3), Doyenne du Comice (S).

* * * * *

THE AGRICULTURAL CREDITS ACT, 1923.

THE PROVISION OF SHORT-TERM LOANS.

Objects.—Under Section 2 of the Agricultural Credits Act, 1923, new facilities have been placed in the hands of farmers, small holders, allotment holders, and other agriculturists, for obtaining short-term loans.

The object of this part of the Act, is the provision of machinery easily accessible to agriculturists, under which they can obtain credit to meet such expenses as the purchase of seeds, fertilisers, feeding stuffs, the purchase of breeding and other live stock, of machinery and implements, the erection of silos, barns, fencing, etc., the purchase of fruit trees, etc.

Outline of the Scheme.—This will be done by establishing Agricultural Credit Societies which will be empowered, subject to certain conditions, to make loans to farmers, small holders or allotment holders, repayable within periods not exceeding five years, and which will also be entitled to assistance, in the shape of money advances from the State.

The first point to be realised by those who wish to avail themselves of the credit facilities provided by this part of the Act, is that these facilities are limited to the provision of loans made by Agricultural Credit Societies to their members. The formation of such a society is, therefore, a necessary precedent to the making of any loans, and it is the first step to be taken in putting the scheme into operation.

The distinctive features of an Agricultural Credit Society—such as is contemplated in the Act, are:—

1. It rests on the fundamental principle of the mutual responsibility of its members.

2. It is local—its members living within a comparatively small area and being known to each other.
3. The liability of each member is limited to the full value of the shares in the society held by him.
4. It may, subject to certain conditions, borrow money from the State for the purpose of making loans to its members, and may also, with the consent of the Minister of Agriculture, borrow from other sources.

The Act provides that the share capital of a society shall consist of an unlimited number of shares of £1 each, held by members of the society, upon each of which a sum of 5s. has been paid up, and that the Minister may, subject to certain regulations, make advances to a credit society, provided that the total sum advanced to a society shall not exceed an amount equal to £1 for every £1 share held by the members upon which 5s. has been paid up. The paid-up share capital, plus this Government advance and any other sums borrowed with the consent of the Minister, may be said to form the total loanable funds out of which the society may make loans to its members. It is clear, therefore, that an essential condition for the establishment of such a society on a satisfactory basis, is that the number of members, and the number of shares held by them, should be sufficient to provide the society with adequate funds in order to make it possible for it to carry on its operations successfully.

The Formation of a Society.—When in any agricultural district there is a wish to form a credit society under the Agricultural Credits Act, the first step to be taken is for the promoters of the society to obtain from local agriculturists or others a sufficient number of promises to take up shares in the society to justify them in taking any further action.

In doing so it should be borne in mind that although these societies are intended solely for the assistance of persons engaged in agriculture, membership is open to any person sufficiently interested in promoting the prosperity of local agriculture to be willing to lend his capital and his credit for that purpose. In this matter the founders will have to exercise their own judgment, although the advice of officers of the Ministry will be placed at their disposal. It is obvious, however, that the larger the society, the more useful it will be, while it is hardly necessary to point out that the difficulties of initiating and carrying on a society with a very small share capital will be very great indeed, if not prohibitive.

The next step in the formation of a society will be to obtain a copy of the Model Rules which have been prepared for adoption by such societies and will be obtainable from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. These rules set out in detail the constitution of such a society, its method of operation, and the manner in which it must be conducted in order to conform with the provisions of the Agricultural Credits Act, 1923, and the Industrial and Provident Societies Acts, 1893-1913, under the latter of which Acts, an Agricultural Credit Society must be registered.

Steps must now be taken to register the society, and for this purpose a letter should be addressed to the Chief Registrar of Friendly Societies, 17, North Audley Street, W.1, asking for the necessary forms of application for registration. These application forms must be filled up in accordance with the instructions which accompany them, and returned to the Chief Registrar, together with the prescribed registration fee. The Industrial and Provident Societies Act of 1893, provides that no society can be registered which does not consist of seven members at least, and for the purpose of registry the application form must be signed by seven members and the secretary. These seven members are referred to in the Model Rules as "the original members."

The receipt by the promoters of an "acknowledgment of registry" from the Chief Registrar marks the coming into being of the society, and it is now enabled to exercise its functions both as regards lending money to its members and borrowing from the Minister. As soon as the society has thus been constituted, its first step will probably be to proceed at once with the allotment of shares in accordance with the society's rules. On allotment the 5s. per share must be paid up by the members, and it is probable that at this point the society will find it necessary to open a banking account in accordance with its rules.

For the next step it may be found most convenient at once to call a summoned general meeting, to elect a committee and officers in accordance with the rules.

The Making of Loans.—As regards the making of loans to members and the application for advances from the Minister, this will necessarily involve very careful consideration by the committee of the society, both as regards the method of making loans, and the appropriate time for making an application for an advance from the Minister. This is a matter of

special importance in the early stages of the society's existence. The total funds within the control of the society at the beginning of its existence are :—

1. The entrance fee of 2s. 6d. per member.
2. The paid-up share capital of 5s. per share.
3. The money advanced by the Minister of Agriculture, which is limited to a sum equal to the full value of the society's share capital for the time being issued, but on this advance the society must *pay interest* at a rate prescribed in regulations made by the Treasury. This rate is at present fixed at 5 per cent. per annum.

From the foregoing the committee of a society should at once realise that an application for an advance from the Minister should only be made when the money is required for the immediate purpose of making loans to the society's members, otherwise it will hold funds which are lying idle, but upon which it has to pay interest. Before any such application to the Minister is made, therefore, it would seem necessary for the society to consider any applications for loans from its members, and to reach a provisional decision as to the gross amount of such loans which it is prepared to make. It will then be in a position to apply to the Minister for the advance of a definite sum sufficient to enable it to make these loans, but within the limits of £1 for each £1 share held by the members.

The Agricultural Credits Account.—The circumstances just described in which a society makes application to the Minister for an advance in order to make loans to its members, in actual practice will not only occur once or at rare intervals, but will recur repeatedly. Moreover, when any of the loans to members, or part of the loans, are paid off, and the society has no immediate call on the surplus funds, the society will again find itself holding funds upon which it has to pay interest, but for which it has no immediate use. Under Section 2 (3) of the Agricultural Credits Act, provision is made for the opening of an account called the Agricultural Credits Account, into which shall be paid (a) such money as may from time to time be provided by Parliament towards defraying the advances and expenses of the Minister directed by this Section to be paid out of the Agricultural Credits Account, and (b) all sums received by the Minister in respect of advances made by the Minister under this Section.

This account will be administered by the Ministry of Agriculture. From what has been said above (and this is a

point which will be shown even more strongly in the Section which follows) a credit society will not be able to afford to hold any substantial sum which has been advanced to it by the Minister, unless it is immediately required for making loans to members. When, therefore, a loan, or part of a loan, to a member is repaid and any money advanced by the Minister is not immediately required for the purpose of making further loans, it will be advisable for the society to refund this money to the Minister. It is true that the rules provide that a society may invest surplus funds in the Post Office Savings Bank or any savings bank certified under the Trustees Savings Bank Act of 1863, or with the approval of a general meeting in a trustee security, but it will probably be more convenient to refund to the Minister any outstanding advance, rather than to adopt this course.

Administrative Expenses of Society.—This is a point which must also receive the very careful consideration of persons engaged in promoting a society. It is essential to realise that the margin of money out of which the administrative expenses of the society are to be met will necessarily be very small. In the early stages of a society the money available for this purpose will be (a) entrance fees of 2s. 6d. per member and (b) the interest on loans to members made out of the paid-up share capital of the society, and out of money advanced by the Minister, less the interest payable by the society in respect of the Minister's advances and the dividend on the paid-up share capital. This point may be illustrated by the following example:—

Number of members of credit society (say)	100
Average number of shares held by each member (say) ...	20
Total number of shares	2,000
Total paid-up share capital (5s. × 2,000)	£500
Maximum amount which may be borrowed from the Minister	£2,000
Total loanable funds (excluding entrance fees)	£2,500

Assuming the rate of interest charged on loans to members is 6 per cent., and assuming the total loanable funds are lent to members for the first year, then—

Interest on £2,500 at 6 per cent.	= £150 0 0
Interest payable on advance from Minister, namely 5 per cent. on £2,000	= £100 0 0
Net income of Society from loans	= £50 0 0
Entrance fees, 100 members at 2s. 6d.	= £12 10 0
Total income for first year	= <u>£62 10 0</u>

Out of this sum the whole administrative expenses of the society, as well as any dividend on the paid-up share capital should be met. It will therefore be clear that a society, the full value of whose share capital is £2,000, will only have a comparatively small sum out of which to meet administrative costs.

Steps are being taken with a view to organising Agricultural Credit Societies, by the Agricultural Organisation Society, 40, Broadway, Westminster, S.W.1, from whom information and assistance in the matter may be obtained. Any further information may be obtained from The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1.

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WILTSHIRE COUNTY EGG LAYING TRIALS.

MAJOR R. F. FULLER.

THE Wiltshire County Council have recently completed their Third Annual County Egg Laying Trials, and a short account of our procedure, some of our difficulties and the results attained will be of interest, especially in those neighbourhoods where similar trials are being arranged.

The Wiltshire scheme was the first of the kind to be put into operation with the approval and support of the Ministry of Agriculture, and commenced in October, 1920. The Horticultural Sub-Committee was asked by the Agricultural Education Committee to take over work in connection with poultry instruction in the county in January, 1920, and at the Sub-Committee's first meeting it was decided to consult poultry keepers as to the steps which might be taken to improve the poultry of the county. At a conference of poultry keepers held in June, 1920, a scheme for holding laying trials in the county was strongly recommended. It will be readily understood that any such scheme requires the full support of local poultry keepers. The scheme was approved by the Ministry in August and the trials were to commence on 1st Oct., 1920, and end on 31st July, 1921.

The trials were intended to discover the standard of efficiency of the poultry in the county and to show the amount of variation; also to form a guide to the individual poultry keepers sending pens of birds as to the efficiency of their poultry, and to show those with low records the desirability of grading up their stock.

In order to be within reach of the county poultry instructor a site was selected on the outskirts of Trowbridge on soil which

admittedly was far from ideal for poultry, but which was typical of a good deal of the heavy land in the neighbourhood.

In the first year's trials 50 pens of 4 pullets each were entered and each pen was housed separately. It was found that this manner of housing was too expensive and for the second year's trials, commencing October, 1921, the houses and runs were modified and adapted so that six pens (24 birds) were housed together, thereby saving labour both in feeding and trap-nesting, and at the same time increasing the number of birds in charge of the manager from 200 to 284. The alteration did not seem to make any appreciable difference to the birds.

The first difficulty was that the houses and runs were not quite finished by the date stipulated and the date of commencement had to be postponed until 15th October. This may have contributed to the fact that 70 birds commenced to moult in the first month.

During the first winter laying was severely checked owing to the runs becoming flooded during heavy rains. Surface drains had to be cut to run the water away, and the altered houses were, in September, 1921, moved to another part of the same field. The hot summer of 1921 was hard on the houses, and during the early part of the following winter we were troubled occasionally by the wet getting in. The third year's trials were held on the same site as in the second year, and the runs, 32 yards long by 18 yards wide, were in quite good condition.

The Committee considered the results of the first year's trials quite satisfactory from an educational point of view. An average of sixty to seventy local poultry keepers per week attended at the trial ground and took a great interest in the methods of management, etc., and, in the opinion of the poultry instructor, small poultry keepers obtained greater benefit from such visits to the trial ground than from lectures. Visitors have in the past been allowed at any time on week days, but it is found that this sometimes interferes with the work of the manager and in future it is proposed to limit visits to two days per week except by appointment with the county poultry instructor.

In order to increase the interest in the trials, Cups and other prizes for pens and birds showing the best score value were provided privately from non-county funds. These prizes the Committee decided should be based on the value of eggs produced rather than the number, in order to emphasise the importance of breeding pullets that lay first grade eggs during the period of high prices. The eggs were graded in accordance with the

methods of the National Utility Poultry Society and priced each week according to the prices published in the Ministry's *Agricultural Market Report*. In the future the grading of eggs will be as decided at the Conference of representatives of the various laying trials at Harper Adams College, held on 5th April last.

The birds were fed with 1 oz. of corn per head (wheat, broken maize and oats) in their litter in the mornings and the same in the afternoons, and during the first two years a wet mash of mixed meals in the middle of the day. Dry mash hoppers were open from 10 a.m. During the third year the wet mash was omitted. The total quantity of mixed corn and meal consumed during the first year averaged 3.84 oz. per day per bird, costing 4d. per bird per week; during the second year the corresponding figures were 4 oz. per day per bird, costing 2½d. per bird per week; and during the third year 4.5 oz. per day per bird, costing 2½d. per bird per week. The rations were not intended to be in any way forcing and the birds were in a good healthy condition at the end of the trials.

The health of the birds has, on the whole, been quite satisfactory, the casualties averaging 9 per year. They were higher during the last year, owing to an unfortunate outbreak of roup. The following figures showing the number of birds that did not lay at all during each of the months of the third year in consequence of sickness, moulting, broodiness or immaturity may be of interest :—

1st	2nd	3rd	4th	Month of 4 weeks.						
				5th	6th	7th	8th	9th	10th	11th
209	211	121	85	40	14	12	14	24	21	21

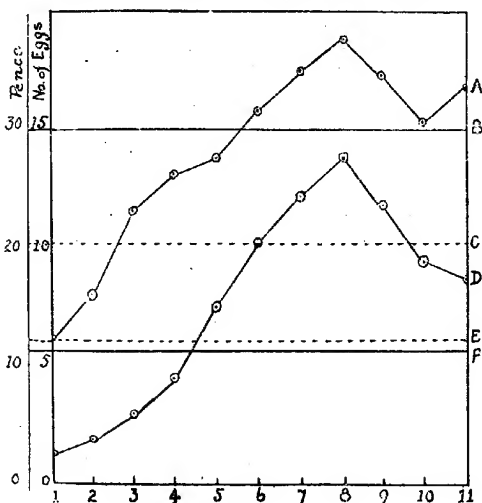
With regard to selection, it is thought that our results emphasise clearly the difficulty of picking out the best layers from immature pullets. The difficulty is that birds that have commenced to lay run the risk of at least a partial moult in consequence of the changed conditions: it is difficult also to estimate the laying capability of immature birds, and if immature it seems that the change is apt to delay the commencement of laying until the price of eggs has appreciably dropped. Broodiness is frequently a handicap, particularly to some breeds. For the small breeder it is recognised that broody hens are required at the right time, but it is not advisable for the tendency to broodiness to be carried to extremes; we have in some cases had birds that have been reported broody during five and six consecutive months.

The results of the trials as regards laying capabilities, while scarcely comparable with the National Trials, indicate clearly

the extent to which local poultry could be improved. They emphasise the great importance of good laying strains and of culling the poor layers, and prove that suitable pullets can be kept profitably even on unsuitable sites. A summary of the results is given on page 659.

With regard to the importance of culling and of trap-nesting in order to cull on the surest lines, the comparisons between the 12 best pens and the 12 worst pens in the summary of results are interesting.

The average gross profit per bird, viz., difference between average cost of food and value of eggs at London Market prices, was as follows:—19s. per bird for the best pen; 14s. per bird average for the 12 best pens; 3s. per bird average for the 12 worst pens; loss 1s. 4d. per bird for worst pen. The following chart clearly shows the possibilities as regards improvement:—



Months of 4 weeks October to July.

- A.—Average Eggs per bird per month of 4 weeks of the 12 pens producing the highest number of eggs.
- B.—Average Score Value per bird per month of 4 weeks of the 12 pens producing the highest score value, 2s. 6d.
- C.—Average Value of Eggs sold locally per bird per month of 4 weeks, 1s. 8½d.
- D.—Average Eggs per bird per month of 4 weeks of the 12 pens producing the lowest number of eggs.
- E.—Average Cost of Food per bird per month of 4 weeks, 1s. 0½d.
- F.—Average Score Value per bird per month of 4 weeks of the 12 pens producing the lowest score value, 11½d.

Another point which the Committee consider important is that local trials on these lines give the county poultry instructor an opportunity of putting into practice the principles of feeding and management which he advocates in his itinerant lectures. This point may not be as important in counties where there is a Farm Institute, but in all branches of agricultural education there is no doubt that the efforts of instructors and advisory officers are greatly helped if they have an opportunity of putting into practice the principles they preach.

As regards the future, the Committee's scheme for next year has been approved by the Ministry, which gives a grant of two-thirds of the capital expenditure as well as two-thirds of the salary of the manager. As a result of the Committee's experience in the past it has been decided to obtain new houses of larger size designed to accommodate an increased number of birds without increased labour. The houses are being made in sections so as to be able to move to different neighbourhoods in the county from time to time. They are to be 10 ft. x 20 ft., accommodating in each half five pens of five birds each, and it is expected that the manager will be able to look after at least 300 birds.

The site selected for next year's trials is on greensand soil at West Lavington, near the Dauntsey Agricultural College, and it will be interesting to be able to show in the future the difference due to the change to a soil more suitable for poultry keeping, while in addition to the interest the trials will undoubtedly create in a new neighbourhood it is hoped that they will be also of considerable interest to the students of the Dauntsey College.

Wiltshire, unfortunately, cannot claim to be one of the leading counties as regards poultry keeping, but there is no doubt that there has been a great increase in the interest taken in the subject during the last three years. As far as is known to the county poultry instructor, there were less than 20 trap-nests in use in the county three years ago—now there are 2,000 in use. It cannot be claimed that our County Laying Trials are entirely responsible for this, but the trials are at least responsible for a share in the progress. The progress has also been helped by the formation of the Wiltshire Poultry Breeding and Egg Recording Society, formed on the lines of the scheme of Co-operative Extension Work in Agriculture and Home Economics of the State of Connecticut, U.S.A.

SUMMARY OF RESULTS OF 3 YEARS' TRIALS.

1st Year (40 weeks).				2nd Year (44 weeks).				3rd Year (44 weeks).													
No. of eggs laid.				No. of eggs laid.				No. of eggs laid.													
Grade.	1st.	2nd.	3rd.	Grade.	1st.	2nd.	3rd.	Grade.	1st.	2nd.	3rd.										
Score	Value.	£ s. d.	Score	Value.	£ s. d.	Score	Value.	£ s. d.	Score	Value.	£ s. d.										
Heavy Breeds—Pen of 4 Birds.																					
Gold Medal	408	232	3	486	7	3	11	481	193	11	561	5	18	3	688	58	1	746	6	5	7
Silver Medal	423	79	0	502	6	12	2	437	109	0	517	5	12	4	662	21	0	683	5	18	0
Bronze Medal	398	140	1	473	6	6	5	449	165	1	529	5	10	11	608	34	0	643	5	3	11
Individual Birds.																					
Gold Medal	165	25	0	185	2	11	3	181	16	1	197	2	3	8	199	5	0	204	1	14	8
Silver Medal	133	32	1	153	2	3	10	183	21	0	203	2	2	9	192	0	0	192	1	13	10
Bronze Medal	147	14	0	161	2	2	11	143	22	0	163	1	17	0	186	6	0	182	1	12	9
Light Breeds—Pen of 4 Birds.																					
Gold Medal	457	89	1	537	7	12	4	568	112	0	648	6	4	7	503	98	1	583	4	9	5
Silver Medal	431	85	1	511	6	18	8	496	69	0	565	5	1	7	502	91	3	582	4	8	6
Bronze Medal	403	94	0	483	5	18	5	516	54	0	570	5	0	9	491	69	1	550	4	1	10
Individual Birds.																					
Gold Medal	144	2	0	146	2	2	10	142	61	0	162	1	15	7	167	11	0	178	1	7	1
Silver Medal	124	23	0	144	2	2	0	147	41	0	167	1	12	5	165	0	0	166	1	6	3
Bronze Medal	123	37	0	143	2	0	0	131	49	0	151	1	12	3	153	13	0	167	1	4	6
AVERAGE OF 12 BEST PENS	395	133	3	470	6	6	0	460	130	2	532	4	18	8	535	73	2	597	4	13	0
AVERAGE OF ALL PENS	291	170	10	365	4	16	2	280	144	7	347	3	1	9	325	152	5	391	2	18	0
AVERAGE OF 12 WORST PENS	171	254	26	247	3	9	6	101	207	6	169	1	6	11	111	236	6	181	1	5	11

TABLE II.

Breed.	1920-21.		Breed Averages—No. of Eggs laid per Bird.		1921-22.		1922-23.	

Anconas	...	107	...	...	...	114	...	100
White Leghorns	...	86	...	...	...	113	...	125
White Wyandottes	...	90	...	...	...	108	...	125
Rhode Island Reds	...	92	...	...	...	118	...	126
Light Sussex	...	103	...	...	...	80	...	90

NOTES ON MANURES FOR OCTOBER.

SIR JOHN RUSSELL, D.Sc., F.R.S.,

Rothamsted Experimental Station, Harpenden, Herts.

Town Refuse Experiments.—Some interesting experiments are being made this year at Rothamsted to compare the effect of ashpit refuse from towns (already described in this *Journal*)* with town stable manure. The crop grown is mangolds, and the manures were applied all at the same rate, namely, 15 tons per acre. The difference in cost was considerable; the ashpit refuse cost nothing, while the town stable manure cost 8s. 9d. per ton; in both cases, however, there was carriage and carting to be paid for, making a total of 10s. per ton on the farm for the stable manure and 6s. 3d. per ton for the refuse. Up to the present there is no difference whatever to indicate that the ashpit refuse will be inferior to stable manure. The condition of the soil is just as good, there has been an equally good growth of plant and equally few gaps. It still remains to be seen whether ashpit refuse will last as well as stable manure, but up to the present the indications are favourable.

It is not the purpose of these notes to "boom" town waste as a manure. We have already heard of one case where an enterprising town authority is inviting farmers to pay 2s. 6d. per ton free on rail for its refuse. A price of this kind cannot be justified. Seeing that the town authority must dispose of its refuse somehow, it is only reasonable that they should put it on rail free of charge, and indeed they should help to bear the burden of the carriage. Five or 6s. per ton on the farm is as much as town refuse is likely to be worth at present prices of other manures.

Spring Dressings.—At Rothamsted this year spring dressings of nitrogenous fertilisers to corn crops have shown up quite well, and it has again appeared, contrary to some of the previous results, that the later applications have been rather more favourable to crop yields than the earlier ones. A great deal must depend on the soil and season, and it is desirable that much fuller information than we have at present should be obtained, for it is a little difficult to understand the results as they stand. The present position is that one can safely recommend spring dressings as being likely to increase winter corn crops, but we are

* Nov., 1922, p. 685; Dec., 1922, p. 838; Jan., 1923, p. 944.

not yet in a position to state exactly what is the best time for applying them. On the other hand, it appears that the top dressing given to potatoes was not as effective as the same quantity of dressing applied with the seed. In 1922, for example, the potatoes receiving no nitrogen but only the basal dressing of potash phosphates and dung gave 6.1 tons per acre. The addition of 3 cwt. of sulphate of ammonia with the seed raised this to 9.7 tons, but when the 3 cwt. were divided into two dressings of $1\frac{1}{2}$ cwt. each, one applied with the seed and the other given later as top dressing, the yield was only 8.6 tons per acre.

Potash as a Fertiliser for Mangolds.—Barnfield plots this year showed striking advantages from potash dressings, and from the comments made by agricultural visitors it seems clear that many farmers do not appreciate the importance of potash for this particular crop. The plants to which no potash was given are not as large nor as healthy as those receiving potassic fertilisers, even though they have been pretty well treated with farmyard manure. There is a tendency for the leaves to be darker and more crinkly, also a tendency for orange streaks to appear in the stems. Provision should always be made for the mangold crop to receive a sufficient dressing of kainit or muriate of potash. Suitable amounts are 5 cwt. of kainit, or $1\frac{1}{2}$ cwt. of muriate of potash, or 3 cwt. of French extra kainit. In many cases salt is a useful addition also.

Mineral Phosphates.—Mineral phosphates are attracting a good deal of attention at present, and a number of experiments are being made in different parts of the country to ascertain their value to farmers.

In a set of experiments with swedes in Radnorshire,* Mr. David Thomas reports the following yields:—

Plot 7. Control (no phosphate)	8 tons per acre.
Plot 1. Superphosphate	12 tons „
Plot 6. Basic Slag	12.7 tons per acre.
Plot 4. Gafsa Phosphate	10.9 tons „

from which it appears that although Gafsa is not as good as superphosphate or slag, it nevertheless served a useful purpose. Other mineral phosphates were not quite so good.

There is considerable evidence that the phosphates must be very finely ground to ensure good results.

The Proper Time to use Farmyard Manure.—A correspondent asks what is the best time for putting farmyard manure

* Radnorshire County Council, Report on Agricultural Work, 1923.

on the land, and on our informing him that he should as a rule apply it in autumn or winter if in the dryer parts of England, but that he can apply it in spring if the winter is mild and wet, replies that he cannot readily draw it out in winter on his heavy land, and if he held it over till the following autumn he would have to wait for a long time ahead before deriving any benefit from it.

The advice to apply farmyard manure in autumn or winter must, of course, be modified whenever circumstances would make the plan more costly than the saving would justify. The clay farmer cannot get his manure on to the land as easily as is possible for anyone farming on lighter soil. If the land happens to be dry in the latter part of the winter, he can readily apply the manure for the mangold crop, but if it is wet there is more difficulty. He could, however, often use it with advantage on the clover leys so long as he does not cut them up too badly. Whatever plan he makes it must be admitted that a heavy land farmer might easily have difficulty in using farmyard manure after February, and might then have to store it. A certain number of cow-keepers are now cutting up straw into short lengths of about 4 in., and this practice certainly improves the manure and facilitates decomposition in the soil, so that later dressings can be given.

Selection of Potash Fertilisers: Present Position.—Experimental work is now proceeding at a number of centres in regard to potash fertilisers, and precise information is being accumulated which will enable the farmer to make a selection suitable to his farm and his crops. The present position is broadly as follows:—

1. Kainit can be used for mangolds on practically all soils: for cereals and leguminous crops on light chalky soils. The amount necessary depends on the composition of the fertiliser, but would be 3 to 5 cwt. per acre of ordinary kainit, or proportionately less of the French extra kainit containing 20 per cent. of K_2O .

2. Muriate of potash can be used for practically any agricultural crop or any soil. It usually gives as good a crop as sulphate of potash, but may not give as good a quality.

3. Sulphate of potash is safest for potatoes where quality is a consideration; it can also be used for horticultural purposes, glass-houses, etc., and is generally associated with good quality of

produce. The following results were obtained at Kirton in 1922:—

Manures.	Yield per Acre.			Total (Ware, Seed and Chats).		
	T.	c.	lb.	T.	c.	lb.
1. No Potash	4	9	24	6	4	80
2. Sulphate of Potash	7	19	104	10	0	16
3. Muriate of Potash	8	1	70	10	2	70
80% Ordinary Commercial						
4. Muriate of Potash 97%	8	3	64	10	4	104
5. Kainit 14%	6	10	56	8	3	0

* * * * *

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Average Price per ton during week ending September 12th.					
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London	
	£ s.	£ s.	£ s.	£ s.	s. d.	
Nitrate of Soda (N. 15½ per cent.)	13.10	13.15	13.10	12.17	16. 7	
" " Lime (N. 13 per cent.) ... ..	...	...	...	12.10	19. 3	
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13. 7*	13. 7*	13. 7*	13. 7*	(N)12.10	
" " " neutral (A. 25¼ per cent.)	14.10*	14.10*	14.10*	14.10*	(N)13. 8	
Kainit (Pot. 12½ per cent.) ... ..	...	...	...	1.14	2. 8	
" (Pot. 14 per cent.)	2. 2	...	2.10	2. 5	3. 3	
Sylvinit (Pot. 20 per cent.) ... ..	...	...	...	2.10	2. 6	
Potash Salts (Pot. 30 per cent.) ... ..	...	...	...	3.10	2. 4	
" " (Pot. 20 per cent.) ... ..	...	...	...	2.10	2. 6	
Muriate of Potash (Pot. 60 per cent.)	8. 5	7. 0	8. 0	7. 0	2.10	
Sulphate of Potash (Pot. 48 per cent.) ... ..	...	...	11.15	10.15	4. 6	
Basic Slag (T.P. 35 per cent.) ... ..	...	...	...	3.12§	2. 1	
" (T.P. 30 per cent.) ... ..	...	...	...	3. 0§	2. 0	
" (T.P. 26 per cent.)	2.13§	2.10§	...	...	...
" (T.P. 24 per cent.)	2. 9§	2. 4§	2. 2§	...	...
" (T.P. 20-22 per cent.) ... ..	...	2. 1§	...	2. 7§	2. 4	
" (T.P. 18 per cent.)	2. 3§	...	1.15§	...	...
Slag Phosphate (T.P. 60 per cent.) ... ..	...	...	...	5.12	1. 9	
Superphosphate (S.P. 35 per cent.)	3.17	...	3.15§	3. 7	1.1†	
" (S.P. 30 per cent.)	3.10	...	3. 7§	3. 0	2. 0	
Bone Meal (T.P. 45 per cent.)	9.10	...	8.15	8.10	...	
Steamed Bone Flour (T.P. 60 per cent.)	8.10†	...	6.15	6.10	...	
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.10	...	

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

MONTHLY NOTES ON FEEDING STUFFS.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),
Animal Nutrition Institute, Cambridge University.

Milk Production of Sows.—The chief care of the successful pig feeder is to keep the breeding sows in good condition both during pregnancy and particularly during the suckling period, so that the piglings when weaned are in a healthy thriving condition. In order to obtain a quick maturing, good quality finished porket or bacon pig it is essential that the weaned pigling should be well nourished during the suckling period.

The capacity of a sow to raise large well-developed litters depends upon her ability to produce the necessary milk. Carlyle at the Wisconsin Experiment Station, and Braxton and Jones, working at the Purdue University under the direction of Professor W. W. Smith, have studied this problem, working with Berkshires, Razor-backs, Poland Chinas and Durocs. The method adopted was to keep the sow and litter separate, and to weigh the piglings immediately before and after each nursing, thus obtaining a measure of the milk produced. The results of these experiments showed that there is considerable variation in the milk capacity of individual sows, as there is in ordinary milch cows, and, as would be expected, the sows which produced the most milk produced the largest litters. The number of piglings in the litter and the weight at weaning time therefore gives a very good indication of the milk capacity of the sow. In the experiments in question the average daily production of milk per sow, on a 10 weeks suckling period, worked out at 5.53 lb., giving a total production of 387 lb. of milk during the suckling period. The amount of milk given by different sows varied from 3.39 lb. to nearly 8 lb. daily. It will be seen that during the suckling period the sow gives half a gallon of milk a day, which fact emphasises the importance of feeding the sow well during the suckling period on materials rich in milk-producing constituents. Sow's milk is considerably richer in protein, ash and fat than cow's milk, the total solids of sow's milk being 19 per cent. as compared with 13.6 per cent. in cow's milk. According to Henry and Morrison the percentage composition of cow's milk and sow's milk is as follows:—

	<i>Solids.</i>		<i>Fat.</i>		<i>Protein.</i>		<i>Milk sugar.</i>		<i>Ash.</i>
Cow's milk ...	13.60	...	4.4	...	3.5	...	5.0	...	0.7
Sow's milk ...	19.00	...	6.7	...	5.9	...	5.4	...	1.0

1923.]

MONTHLY NOTES ON FEEDING STUFFS.

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DESCRIPTION.	Price per Qr.	Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.	
		Cwt.	Ton.						
									s.
Theat, British	—	—	9/4	9 7	0 15	8 12	71 6	2/5	1.29
atley, British Feeding	—	—	7/8	7 13	0 12	7 1	71	2/-	1.07
at, Danubian	29/6	400	8/3	8 5†	0 12	7 13	71	2/2	1.16
at, English, White	—	—	10/6	10 10	0 13	9 17	59.5	3/4	1.78
at, Black and	—	—	—	—	—	—	—	—	—
" Grey	—	—	8/4	8 7	0 13	7 14	59.5	2/7	1.38
" Canadian No. 2	—	—	—	—	—	—	—	—	—
Western	28/9	320	10/1	10 2	0 13	9 9	59.5	3/2	1.70
" No. 3	27/9	"	9/9	9 15	0 13	9 2	59.5	3/1	1.63
" Feed	27/6	"	9/8	9 13	0 13	9 0	59.5	3/-	1.61
" American	24/-	"	8/5	8 8	0 13	7 15	59.5	2/7	1.38
" Argentine	24/-	"	8/5	8 8	0 13	7 15	59.5	2/7	1.38
Isaac, American	43/6	480	10/2	10 3†	0 13	9 10	81	2/4	1.25
" Argentine	36/9	"	8/4	8 7	0 13	7 14	81	1/11	1.03
Isaac, Rangoon	—	—	7/4	7 7†	1 11	5 16	67	1/9	0.94
Isaac's officials:—	—	—	—	—	—	—	—	—	—
Isaac, British	—	—	—	5 15	1 6	4 9	45	2/-	1.07
" Broad	—	—	—	6 10	1 6	5 4	45	2/4	1.25
Middlings, Coarse,	—	—	—	—	—	—	—	—	—
British	—	—	—	8 7	1 2	7 5	64	2/3	1.20
Pollards, Imported	—	—	—	5 15†	1 6	4 9	60	1/6	0.80
Meal:—	—	—	—	—	—	—	—	—	—
Barley Meal	—	—	—	9 12	0 12	9 0	71	2/5	1.34
Maize	—	—	—	11 0	0 13	10 7	81	2/7	1.38
" Germ Meal	—	—	—	9 0	0 18	8 2	85.3	1/11	1.03
" Gluten-feed	—	—	—	8 12	1 6	7 6	75.6	1/11	1.03
Locust Bean Meal	—	—	—	8 0	0 9	7 11	71.4	2/1	1.12
Bean Meal	—	—	—	12 10	1 11	10 19	67	3/3	1.74
Fish	—	—	—	17 0	4 6	12 14	53	4/10	2.59
Linseed	—	—	—	20 12	1 10	19 2	119	3/3	1.74
" Cake, English	—	—	—	11 13	1 17	9 16	74	2/8	1.43
9 1/2	—	—	—	—	—	—	—	—	—
Cottonseed Cake, English	—	—	—	7 12	1 14	5 18	42	2/10	1.52
5 1/2	—	—	—	—	—	—	—	—	—
" " Egyptian	—	—	—	7 5	1 14	5 11	42	2/8	1.43
5 1/2	—	—	—	—	—	—	—	—	—
Decorticated Cottonseed	—	—	—	—	—	—	—	—	—
Meal 7 1/2	—	—	—	11 12	2 13	8 19	71	2/6	1.34
Coconut Cake 6 1/2	—	—	—	8 10	1 10	7 0	73	1/11	1.03
Ground Nut Cake 7 1/2	—	—	—	8 10	1 15	6 15	56.8	2/5	1.29
Palm Kernel Cake 6 1/2	—	—	—	5 10†	1 3	4 7	75	1/2	0.62
" Meal 2 1/2	—	—	—	5 0	1 4	3 16	71.3	1/1	0.68
Feeding Treacle	—	—	—	6 5	0 8	5 17	51	2/4	1.25
Brewers' Grains:—	—	—	—	—	—	—	—	—	—
Dried Ale	—	—	—	6 2	1 4	4 18	49	2/-	1.07
" Porter	—	—	—	5 15	1 4	4 11	49	1/10	0.98
Wet Ale	—	—	—	1 1	0 9	0 12	15	0/10	0.45
" Porter	—	—	—	0 18	0 9	0 9	15	0 7	0.31
Malt Culms	—	—	—	6 10	1 13	4 17	43	2/3	1.20

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of August and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local markets by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s per ton. The food value per ton is therefore £8 10s per ton. Dividing this figure by 75, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22.4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1.26d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 12s. 7d.; P₂O₅, 4s. 4d.; K₂O, 2s. 4d.

The nutritive ratio of sow's milk on the basis of the composition given above works out at 1 : 8.5, so that it becomes necessary to feed the brood sow on a mixture having a fairly narrow ratio, and in view of the demand upon the sow for milk, a very liberal amount of food should be given. This is in accord with the experience of practice, it being commonly held by all successful pig breeders that you cannot do a brood sow too well during the suckling period. The practical advice which can be given as the result of the above experiments is: Breed for milk capacity from the sows which give large litters and finish them well as weaned piglings; feed the sows well on a mixture of meals to which a protein-rich feeding stuff has been added; and, above all, do not stint the brood sows for food during the suckling period, since a stinting policy at this time has to be more than paid for at a later period.

FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£ s.	£ s.	£ s.		s. d.	d.
Wheat - - - -	7 12	0 15	6 17	71.6	1 11	1.03
Oats - - - -	6 7	0 13	5 14	59.5	1 11	1.03
Barley - - - -	7 8	0 12	6 16	71.0	1 11	1.03
Potatoes - - - -	1 18	0 3	1 15	18.0	1 11	1.03
Swedes - - - -	0 15	0 2	0 13	7.0	1 11	1.03
Mangolds - - - -	0 14	0 2	0 12	6.0	1 11	1.03
Good Meadow Hay - -	3 15	0 13	3 2	31.0	2 0	1.07
Good Oat Straw - -	2 0	0 6	1 14	17.0	2 0	1.07
Good Clover Hay - -	4 4	1 0	3 4	32.0	2 0	1.07
Vetch and Oat Silage - -	1 15	0 7	1 8	14.0	2 0	1.07

THE Director of the Rothamsted Station wishes to remind farmers and others interested in agriculture that the field

**Farmers' Visits
to Rothamsted
Experimental
Station.**

experiments on the manuring of root crops conducted at Rothamsted provide at this time of the year a very striking series of demonstration plots. The most important of these experiments are:—

(1) *Potatoes*

- The effects of various potash manures (sulphate of potash, muriate of potash, kainit, sylvinite, etc.).
- The effect of increasing dressings (from nothing up to 4½ cwt. per acre) of sulphate of ammonia in a complete fertiliser on the yield and quality of the tubers.
- Comparative trials with certain new fertilisers.
- Comparisons of yields from seed potatoes fresh from Scotland with those from once grown seed.

(2) *Mangolds*

(a) The fertilising value of certain types of town refuse as compared with dung.

(b) Continuous mangolds (47th year). Showing the effects of various manurial schemes.

(3) *Sweedes*

The use of sulphate of ammonia as a top dressing to supplement phosphates, potash, and dung applied at sowing time.

(4) *White Turnips*

Comparisons of various green manuring crops (mustard, tares, trifolium, etc.), as a preparation for roots. It is desired to find out how far dung can be substituted by green crops ploughed in.

The Secretary of the Station will be glad to arrange for farmers' parties of any size to be conducted round the experimental plots at any time before lifting. In cases, however, where it is difficult to fix a date in advance, farmers are invited to go at their own convenience, and the necessary arrangements will be made on arrival. At least three hours should be allowed for a tour round the farm. Lunch and tea can readily be obtained in Harpenden. The Midland Railway Station (Harpenden) is about half a mile from the Laboratory and the Great Northern Station about two miles. Farmers going by road will find the Laboratory on the west side of Harpenden Common.

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REPLIES TO CORRESPONDENTS.

Formaldehyde and Fruit Tree Pests.—E.T. asks whether formaldehyde is of any use against insect pests or fungi of fruit trees.

Reply: It is of no use against insect pests of fruit trees and there do not appear to be any records of it being used against fruit fungi.

Digestibility Trials of Feeding Stuffs.—F.S. asks whether the figures given for digestibility in the Ministry's Miscellaneous Publication No. 32 (*Rations for Live Stock*) are theoretical or based on actual trials, and if the latter, what animals were used.

Reply: The figures given are average figures from experiments carried out with cattle or sheep, which differ very little from one another in their power of digestion. Pigs differ from cattle and sheep appreciably but not very greatly; the number of digestibility experiments which have been made with pigs is not very large. Tables of digestibility of foods when fed to pigs are given in Kellner's "Scientific Feeding of Animals," Henry & Morrison's "Feeds and Feeding," and Armsby's "Principles of Animal Nutrition."

Sainfoin.—G.R. asks whether it is a fact that sainfoin should not be sown on the same land without a long interval intervening.

Reply: In the absence of adequate evidence to the contrary it would be advisable to respect the general opinion to the extent at least of allowing the land to be free of the crop for the same length of time as it has borne it.

Bacterial Fertilisers.—H.Q. asks for information as to bacterial fertilisers for use with cereals.

Reply: In a lecture, delivered at Weimar in June, 1921, Professor Lemmermann, of Berlin, divided bacterial manures into two classes:—(1) those intended for inoculation of leguminous plants; (2) those intended for use with other plants. As regards the latter he concluded:—"All the inoculation manures advertised for use with other than leguminous plants, with corn, root crops, potatoes, etc., cannot accordingly be recommended, but, on the basis of our present knowledge, a warning must be given against their employment."

Lime in Basic Slag.—J.P. asks the percentage of free lime in present-day slag.

Reply: While an analysis of old-fashioned slag would probably show from 40–50 per cent. of lime only a very small proportion of this would be free lime. The proportion of free lime in present-day slag is likewise very small, probably 2 or 3 per cent.

Oil from Home-grown Linseed.—K.O. asks about oil-content of home-grown linseed.

Reply: The oil-content of linseed forms the subject of a paper in Vol. VII (March, 1915) of the Journal of Agricultural Science, and of an article in this *Journal*, February, 1916. In this article reference is made to the prevalence of a belief that "linseed grown at home contains appreciably less oil than that which is usually imported." This belief is shown by figures of trials to be without foundation.

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Foot-and-Mouth Disease.—*Bedfordshire.*—No further outbreaks having occurred, all general restrictions imposed in connection with this group of outbreaks were withdrawn on 9th September.

Hampshire (Alton district) and Surrey.—There have been no fresh developments in this area and the restrictions were withdrawn on 15th September.

Yorkshire West Riding.—Disease was found to exist at Templeborough, Rotherham, on 27th August, the affected animals consisting of pigs kept in a hotel yard. There have been no further developments in this area, and the usual restrictions which were imposed were withdrawn on 27th September.

Lancashire.—On 28th August, an outbreak occurred at Norbreck, Blackpool, and on 30th August, a further outbreak occurred at Cloughton, Garstang, which was within the original prohibited area, but at its extremity. It was therefore necessary to extend the area under restrictions. In the extended area, further outbreaks occurred, namely:—on 3rd September at Carleton, Poulton-le-Fylde (two), and Bispham, on 6th September at Bispham and at Carleton, on 7th September at Leyland, on 8th at Carleton, on 13th at Roesall, and on 18th at Bispham.

Cheeshire.—On 4th September, disease was confirmed at Shavington near Crewe in animals which had arrived at Fleetwood from Ireland on 28th August. These cattle had been unloaded at Crewe on 1st September and as Crewe market was held on 3rd September the possibility of further outbreaks arose. Arising out of the distribution of animals via Crewe, further outbreaks were confirmed at Wistaston on 6th September in cattle which had used the same railway siding as the Shavington animals, on 7th September at Weston, on 8th at Calveley and on 9th at Basford, Nantwich (two), and Wistaston.

In all cases the animals had been purchased in Crewe market or had passed through the Crewe loading docks, subsequently, further outbreaks have occurred in the vicinity of those referred to, bringing the total in this area to 22.

Bucks.—The initial outbreak in this area at Wotton Underwood on 7th September, was directly due to the movement of sheep from Crewe. This outbreak gave rise to others in the vicinity on 10th September at Waddesdon and Wotton Underwood, and on 13th and 14th September at Kingswood, Aylesbury.

Southampton district.—Commencing on 4th September, a fresh series of outbreaks was brought to light by the confirmation of disease at West End, Southampton. Further outbreaks occurred at West End on 5th, 6th, 7th and 10th September, all the premises being in close proximity to those on which disease first appeared.

Devonshire.—Four outbreaks have been confirmed in the Torquay district, two on premises in the occupation of the same owner, at Torquay and Cockington on 6th September, and two on 7th and 12th September at Cockington, which were probably due to the movement of animals from one of the former outbreaks.

Following upon the initial Cheshire outbreak, the existence of disease was confirmed on the Landing Place for Irish animals at Fleetwood on 4th September, and the Ministry accordingly prohibited entirely the landing of animals from Ireland. Arrangements were immediately made for tracing the affected animals back to the place of origin in Ireland, but exhaustive enquiries failed to indicate that foot-and-mouth disease existed in Ireland, and the Ministry reached the conclusion that disease was introduced into the Landing Place from one of the local centres of infection in the Blackpool district.

In the circumstances the Ministry issued an Order on 7th September, taking immediate effect, withdrawing the prohibition on the landing of animals from Ireland, and permitting importation under the usual conditions except as regards certain ports in contiguity to outbreaks.

Map of Wart Disease Infected Areas.—The Ministry has issued a map showing the principal districts which are scheduled as infected areas under the Wart Disease of Potatoes Order of 1923. This map will be of particular value to dealers in potatoes, since the movement of potatoes from the infected areas to other districts is prohibited except as regards potatoes of immune varieties for ware purposes. A list of the areas is appended to the map, copies of which can be obtained from the Offices of the Ministry, 10, Whitehall Place, London, S.W.1, price 6d., post free.

List of Potato Varieties.—The Ministry is informed that a list of the names of all the known varieties of the potato, together with their synonyms, has been compiled by the Board of Agriculture for Scotland. The list comprises 1,300 names, and indicates whether the varieties are immune from or susceptible to wart disease, in all cases where that fact is known. There is no doubt that the publication should be of considerable value to potato growers, merchants, and to the trade in general. Copies can be had on application to the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh.

National Rat Week.—The week beginning Monday, 5th November, 1923, has been fixed by the Ministry as "Rat Week." The object is to secure by organised and simultaneous action throughout the country the largest possible destruction of rats. It also affords an opportunity of calling public attention to the damage caused by them and of reminding the public that it is the duty of all occupiers of premises infested with rats and mice to destroy these pests. Where they fail to do so voluntarily, the Local Authority may put into operation their powers under the Rats and Mice (Destruction) Act, 1919.

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NOTICES OF BOOKS.

A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States.—(R. B. Thomson and H. B. Sifton: Univ. of Toronto Press, 1922). The authors are to be congratulated on the production of an excellent and nicely illustrated little work, mainly intended, it is true, for readers in Canada and the United States, but giving useful information on many plants which are also common in Britain. The plan of the book is to deal in turn with plants dangerous when included in hay and coarse feeds, plants dangerous in pasture or on the range, those dangerous in ground feeds, and those which are rarely observed to cause death in animals. Each species is dealt with with reference to its relationship to Canadian and United States farming, and the information given is practical and clearly written. It is worthy of notice that whereas so many books nowadays are cheaply produced the work under notice is well printed on art paper and enclosed within a limp linen cover—a pleasure to handle.

The Story of the Maize Plant.—(Paul Weatherwax, Chicago: Univ. of Chicago Press, \$1.75). This excellently produced little book is really of chief interest for American readers, or those in the numerous countries where maize can be successfully ripened and is extensively grown. Certain parts of it, however, are of interest to British readers, for one chapter deals with the products and uses of the maize plant, though the space devoted to it as a food for live stock is but a brief sketch. The same remark may be made of the references to ensilage and pasturing of the crop. The volume nevertheless deals systematically with the origin and botanical characteristics of the plant, its cultivation and growth, the green plant and the seed, heredity, and breeding, and generally with maize in its relation to man, forming a clearly written and attractive account of one of the world's most wonderful food plants. Maize has become an important grain food on British farms, and the green crop where successfully grown in the southern counties is a highly valuable fodder, especially for milch cows or pigs, while it may very successfully be stored in the form of silage. Any book therefore that will help us to understand it better is welcome, and Weatherwax brightens his story with apt references to the legendary origin of maize as a food crop, until in the words of Bayard Taylor it became

"The annual storehouse of a nation's need,
From whose abundance all the world may feed."

ADDITIONS TO LIBRARY.

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- Dunlop, J.—*American Agriculture and Some Hints Therefrom.* (8 pp.) Glasgow: Scottish Agricultural Publishing Co., 1923, 6d. net. [63.73.]
- Coulter, M. C.—*Outline of Genetics with Special Reference to Plant Material.* (211 pp.) Chicago: University Press; Cambridge: University Press, 1923, 4s. 6d. [575.1(02).]
- Griffith, J. J.—*Lime and Liming.* (9 pp.) Bath: Herald Press, 1923. [63.15.]
- National Institute of Agricultural Botany.—*Methods of Seed Analysis.* (16 pp.) Cambridge, 1923, 1s. [63.1951.]

Field Crops.

- Leppan, H. D., and Bosman, G. J.—*Field Crops in South Africa.* (360 pp.) Johannesburg: Central News Agency, Ltd., 1923, 21s. net. [63.3(02); 63(68).]
- Stapledon, R. G.—*The Cultivation and Varieties of Oats.* (17 pp.) Bath: Herald Press, 1923. [63.314(04).]
- Weathercox, P.—*The Story of the Maize Plant.* (260 pp.) Chicago: University Press, 1923, \$1.75. [63.315(02).]
- Stuart, W.—*The Potato: Its Culture, Uses, History, and Classification.* (325 pp.) Philadelphia and London: J. B. Lippincott Co., 1923, 12s. 6d. [63.512(03).]
- Scotland Board of Agriculture.—*Miscellaneous Publications No. 3:—The Maintenance of Pure and Vigorous Stocks of Varieties of the Potato.* (64 pp.) Edinburgh, 1923, 1s. net. [63.512(04).]
- Colorado Agricultural Experiment Station.—*Bulletin 281:—Methods of Handling Hay in Colorado.* (39 pp.) Fort Collins, 1923. [63.1982.]

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- Mourre, C.—*La Lavande Française: sa Culture, son Industrie, son Analyse.* (170 pp.) Paris: Gauthier-Villars et Cie., 1923. [63.345.]
- U.S. Department of Agriculture.—*Farmer's Bulletin 1320:—The Production of Cucumbers in Greenhouses.* (29 pp.) Washington, 1923. [63.513(04).]

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- Food Investigation Board, Department of Scientific and Industrial Research.—*Special Report No. 12:—Drown Heart—A Functional Disease of Apples and Pears, Franklin Kidd and Cyril West.* (36 pp. + xix plates.) London: H.M. Stationery Office, 1923, 4s. 6d. net. [63.21.]

Live Stock.

- Corrie, F. E.—*The Mineral Needs of Farm Stock. The Supply of Lime and Phosphate to Animals.* (8 pp.) The Author, Star Cottage, Lingfield, Surrey, 1923, Free. [612.394.]
- Rowlands, M. J.—*Open-Air Pig Breeding. Scientific and Practical.* (245 pp.) London: Vinton & Co., 1923, 7s. 6d. net. [63.64(02).]
- Iowa Agricultural Experiment Station.—*Bulletin 206:—Self-Feeders for Swine.* (pp. 97-143.) Ames, 1922. [63.6: 69.]

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- Leeds University and the Yorkshire Council for Agricultural Education.—*Report 181:—Clean Milk and its Production.* (7 pp.) Leeds, 1923. [614.32.]
- Illinois Agricultural Experiment Station.—*Bulletin 244:—The Feed Cost of Milk and Fat Production as Related to Yields.* (pp. 551-573.) Urbana, 1923. [63.714.]
- Illinois Agricultural Experiment Station.—*Bulletin 241:—Comparative Expense of Mechanical and Hand Milking.* (pp. 491-506.) Urbana, 1923. [63.713; 63.714.]
- Food Investigation Board, Department of Scientific and Industrial Research.—*Special Report 13:—Studies in Sweetened and Unsweetened (Evaporated) Condensed Milk.* (103 pp.) London: H.M. Stationery Office, 1923, 4s. net. [63.715.]
- Ministry of Health.—*Reports on Public Health and Medical Subjects No. 17:—Notes on the Pasteurisation of Milk.* (14 pp.) London: H.M. Stationery Office, 1923, 2d. net. [63.717.]

Poultry and Bees.

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